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PART II

# DEPARTMENT OF ENERGY

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## RESIDENTIAL CONSERVATION PROGRAM

## Proposed Rulemaking and Public Hearings

[6450-01-M]

## DEPARTMENT OF ENERGY

[10 CFR Part 456]

[Docket No. CAS-RM-79-101]

## RESIDENTIAL CONSERVATION SERVICE PROGRAM

### Proposed Rulemaking and Public Hearing

AGENCY: Department of Energy.

ACTION: Notice of Proposed Rulemaking and Public Hearings.

SUMMARY: The Department of Energy (DOE) proposes to implement the Residential Conservation Service (RCS) Program pursuant to Part 1 of Title II of the National Energy Conservation Policy Act (NECPA), Pub. L. No. 95-619, 92 Stat. 3206, *et seq.* The purpose of the program is to encourage the installation of energy conservation measures, including renewable resource measures, in existing houses by residential customers of larger gas and electric utilities and home heating suppliers. Larger utilities are required and home heating suppliers may volunteer to provide Residential Conservation Service Programs. The State may submit State Plans to DOE. The State Plans would require larger utilities to participate and could include, in the Governor's discretion, nonregulated utilities (e.g., municipalities and cooperatives) and/or home heating suppliers. If a State chooses not to submit a plan, DOE would require regulated utilities in the State to carry out an RCS Program for their customers. When nonregulated utilities are not included in a State Plan, they are required to submit their own plans for RCS Programs.

The proposed rules set out the requirements for State Plans and Nonregulated Utility Plans. In addition, they address certain prohibitions, and exceptions thereto, concerning utilities' supply, installation, and financing of energy conservation measures, and they outline the situations and terms under the which Federal Standby Authority would be exercised.

Under the State Plans (or Nonregulated Utility Plans), larger utilities would be required to offer Program Announcements" describing the Residential Conservation Service (RCS) Program to each of their residential customers. These utilities would also be required to make available to those customers lists of contractors and suppliers of energy conservation measures, as well as lending institutions that will finance energy conservation measures. The residential customers would be able to obtain "energy audits" of their homes from these utilities. Each audit would identify with respect to that house costs and savings involved in the installation of energy conservation measures appropriate for a house of that category in that climatic region. Finally, the larger utilities would offer to arrange the installation and financing of whatever suggested measures the customer desired. The measures installed under the program would have to meet the Federal material and installation standards. Home heating suppliers may offer the RCS Program to their customers if the Governor includes them in the State Plan. The measures installed used under the program would have to meet the Federal material and installation standards.

The treatment of certain costs incurred by a utility in carrying out the RCS Program are in some circumstances mandated by NECPA and the proposed rules; in other circumstances the proper treatment of costs is left to the discretion of the State Regulatory Authority (or the nonregulated utility where the program is carried out by such a utility). The costs of informing customers of the program are to be treated as a current expense; costs incurred by a utility for materials and labor in installing measures must be charged to the customer for whom the work is done. Most of the other costs may be treated in the manner chosen by the State Regulatory Authority (or nonregulated utility).

While there is a general prohibition on utilities themselves supplying, installing, or financing energy conservation measures, there are a number of exceptions to this prohibition. There is a "grandfather clause" that allows utilities that were so engaged when NECPA was enacted to continue to supply, install, or finance measures. There is an exemption where a State law or regulation in effect when NECPA was enacted either requires or permits a utility to supply, install, or finance measures. There is also an exception for loans under $300 and the supply, installation, and financing of furnace efficiency modifications, clock thermostats, and load management devices. There is a provision allowing the Secretary of Energy to waive the prohibition where he finds such activity would not be anticompetitive, unfair, or deceptive. Home heating suppliers may supply, install, and/or finance energy conservation measures.

DATES: Written comments must be received by May 25, 1979, 4:30 p.m., e.d.t., in order to ensure their consideration. Hearings will be held at the places and on the dates indicated below.

ADDRESSES: Comments and requests to speak at the hearings should be addressed to: Margaret W. Sibley, Office of Conservation and Solar Applications, Department of Energy, 20 Massachusetts Avenue, N.W., Washington, D.C. 20545. See "Comment Procedures" under Supplementary Information below.

HEARINGS: Public Hearings will be held in seven cities, beginning at 9:00 a.m. local time on the dates and locations specified below:

| City | Hearing date | Requests to testify to be received by 4:30 p.m., e.s.t. | Hearing location |
|---|---|---|---|
| Philadelphia | April 2-4 | March 22 | International House, University of Pennsylvania, 3701 Chestnut Street. |
| New Orleans | April 9-11 | March 29 | Fairmont Hotel, Baronne Street. |
| Boston | April 17-19 | April 5 | J. W. McCormack, Post Office and Courthouse, Post Office Square. |
| Washington, D.C. | April 24-26 | April 12 | Room 2105, 2000 M Street, N.W. |
| St. Louis | April 30-May 2 | April 19 | Federal Mart, 405 S. 12th Street. |
| San Diego | May 7-9 | April 26 | Naval Training Center. |
| Salt Lake City | May 14-16 | May 2 | Ramada Inn, 999 S. Main. |

FOR FURTHER INFORMATION CONTACT:

James R. Tanck, Director, Residential Conservation Service Program, Office of Conservation and Solar Applications, Department of Energy, Room 2251, 20 Massachusetts Avenue, N.W., Washington, D.C. 20545, (202) 376-4708.

Margaret W. Sibley, Office of Conservation and Solar Applications, Department of Energy, 20 Massachusetts Avenue, NW., Washington, D.C. 20545, (202) 376-4802.

SUPPLEMENTARY INFORMATION:

I. Introduction.
II. Subpart A—General Provisions and Definitions.
III. Subpart B—Procedural Requirements for State Plans.
IV. Subpart C—Content of State Plans.
V. Subpart D—Nonregulated Utility Plans.

VI. Subpart E—Supply, Installation and Financing by Utilities.
VII. Subpart F—Federal Standby Authority and Enforcement Provisions.
VIII. Subpart G—Renewable Resource Material and Installation Standards.
IX. Subpart H—Energy Conservation Material Standards.
X. Subpart I—Energy Conservation Installation Standards.
XI. Regulatory Analysis.
XII. Environmental and Urban Impact Analysis.
XIII. Consultation with Other Federal Agencies.
XIV. Comment and Hearing Procedures.

## I. Introduction

The Department of Energy (DOE) proposes to amend Chapter II of Title 10 CFR by adding a new Part 456. The proposed regulation will fulfill the requirements of Title II, Part 1, of the National Energy Conservation Policy Act (NECPA), Pub. L. No. 95-619.

DOE has approached the development of the proposed rule intending that the Residential Conservation Service Program ("RCS Program") be a State initiated and directed activity, or in the case of a nonregulated utility not covered by a State Plan, a nonregulated utility initiated and directed activity. Consequently, the proposed rule leaves it to the State to make many of the decisions regarding State functions and utility programs when they develop the State Plan. Similarly, for those nonregulated utilities which submit plans directly to the Secretary, the proposed rule leaves many decisions about the program to the utility in the development of its plan.

The choice between a prescriptive rule or a flexible rule was most difficult. On the one hand, there was a concern that a flexible rule would place too great a planning burden upon States. Furthermore, DOE was concerned that a non-prescriptive rule might result in utility and home heating supplier programs which fail to give full effect to the legislation and the proposed rule. On the other hand, a prescriptive rule appeared to reduce the opportunity for States to integrate the RCS with other State residential conservation activities as well as the chance to adopt a program to meet the particular circumstances of the State.

The approach chosen for the proposed rule takes neither extreme. Instead it reflects DOE's desire to provide States substantial flexibility in developing RCS Programs by setting performance criteria for certain program activities. The proposed rule provides more prescriptive guidance in only those areas in which DOE feels such standards are required to ensure effective implementation of the program.

To alleviate the planning burden upon the States, DOE will provide technical assistance and guidance to the States in preparing State Plans. DOE recognizes that it must actively provide assistance when States desire it. For example, DOE will develop model energy audit procedures which may be utilized by States (or nonregulated utilities) in their plans. Further, this approach will allow significant interaction between individual States and DOE in developing RCS Programs which are effectively tailored to provide energy conservation services to homeowners in each State.

## II. Subpart A—General Provisions and Definitions

Subpart A contains three general provisions as well as definitions. The first general provision relates to petitions by covered utilities concerning conflicts of laws. Section 220 of NECPA states that nothing in NECPA supersedes any State or local law or regulations except to the extent that the Secretary determines for good cause that such law or regulation either prohibits a utility from taking an action required under NECPA or permits or requires a utility to take an action prohibited under NECPA. These determinations are made pursuant to a petition by a utility. Section 456.102(a) provides the procedure by which such petitions shall be filed. Section 456.102(b) states that the Assistant Secretary for Conservation and Solar Applications will give notice of these petitions to the Governor, State Energy Office, and State Regulatory Authority so that they may comment on the petition. Section 456.102(c) makes clear that once a final order has been issued superseding a State or local law or regulation, that order is effective not only with respect to the utility making the particular petition but also with respect to any other similarly situated utility.

The second general provision relates to appeals. Section 456.103 provides that appeals from orders, findings, or determinations made under § 456.102 or Subpart E are to be filed in accordance with Subpart H of Part 205 of Title 10, Code of Federal Regulations.

The third general provision, § 456.104, finds its basis in Section 211(b) of NECPA. Subsection (c) of this provision makes clear that a utility which meets the definition of a covered utility is fully subject to the requirements of these rules and the applicable plan whether or not it is included on the list published in accordance with this provision.

Section 210 of NECPA defines certain terms used in the RCS Program. Section 456.102 of the proposed rules repeats these definitions and contains other definitions used in the proposed rules. Specific definitions are also provided for the various energy conservation and renewable resource measures.

The definition of "covered utility" finds its basis in Section 211 of NECPA, which limits coverage of the RCS to larger utilities. The term "eligible customer" for the most part, repeats the definition in NECPA of "residential customer." DOE understands this term to include all people who buy gas or electricity from a covered utility, or heating oil from a home heating supplier, for use in a residential building, as defined in NECPA. This includes both owners and tenants.

"Energy audit" is the term used in the regulation to indicate the inspection called for in Section 215 of NECPA.

The proposed rule divides the "residential energy conservation measures" in Section 210 of NECPA into two categories: (1) "Energy conservation measures" which include the measures which conserve energy, but do not use a renewable energy source, and (2) "renewable resource measures" which make use of solar and wind energy. The list of measures specifically identified in Section 210 was expanded to include certain measures which are eligible for residential energy tax credit provided in the Energy Tax Act of 1978. Measures added from the tax credit eligibility list are duct insulation, pipe insulation, thermal windows, thermal doors, and energy usage display meters. Replacement gas burners are not included as a measure in the proposed rule (though they are eligible for tax credits) because these burners usually are installed to replace oil burners in the course of a change from oilfired to gasfired heating. The RCS Program will not include measures which require changing fossil fuel sources. Moreover, DOE has not determined that replacing one gas burner with another saves energy. Further, material standards do not exist for replacement gas furnace burners for gas furnaces.

The term used in NECPA, "devices for modifying flue openings," could literally include vent dampers, flue dampers, barometric dampers, reduced vent connectors, blast gates (fixed flue restrictors), extended draft hoods, and heat exchangers. DOE, however, defined the term "flue opening modifications" to include only vent dampers since a safe and effective installation could be obtained with the development of standards for vent dampers.

DOE determined that flue dampers (automatic dampers located upstream of the draft hood or barometric dampers) and blast gates provided serious potential safety hazards and therefore should not be included in the RCS Program. Barometric dampers, moreover, were not included in the program because the primary use of this device is not to save energy.

Reduced vent connectors, extended draft hoods and heat exchangers were not included because DOE had insufficient information regarding the potential energy savings which might result from installation. DOE will continue to evaluate these devices as new information becomes available.

"Replacement solar swimming pool heaters" are included in the definition of renewable resource measures even though they are not eligible for the residential tax credit. It was determined that solar pool heaters which replaces existing nonsolar pool heaters reduce the use of fossil fuels.

Heat pumps are included as a "replacement furnace," even though they are not eligible for tax credits, because heat pumps have been determined to save energy in some locations when they replace electric resistance space heating.

At the present time it is unclear whether or to what extent passive solar space heating and cooling systems will be eligible for tax credits. Whatever the resolution of that issue, DOE believes that the RCS Program should broadly include passive systems as renewable resource measures.

NECPA gives the Secretary the authority to add other energy conservation or renewable resource measures to the list of measures for the RCS Program. We have not evaluated additional measures (other than those addressed herein) for inclusion in this proposed rule. However, we realize there may be others which are worth considering. No measure or product may be treated in this program as an energy conservation measure, a renewable resource measure, or a suggested measure unless the Secretary designates it as such by rule (see Section 210(11)(I) of NECPA). We seek comment on additional measures which we could include in the list in our final rule. In addition, once the rule is final, we will periodically consider adding other measures by rule.

In general, we believe additional energy conservation measures and renewable resource measures should meet the following criteria:

(1) The measure's primary purpose must be the conservation of energy or the use of a solar or wind energy;

(2) The measure must be shown to have the potential to save enough energy to pay for its purchase and installation in a substantial fraction of the residential buildings in at least one climate zone.

(3) The measure must not increase consumption of nonrenewable energy in typical houses in a substantial portion of the United States. That is, we will not add measures which would save energy in houses in some areas of the country but would increase energy use if installed in houses in other areas.

(4) The measure must be shown to have a significant energy savings potential for the Nation if installed in houses in which it is appropriate.

(5) The measure must not involve switching from the use of one nonrenewable fuel to another.

(6) Test data or acceptable methods of calculation must be available to estimate the energy cost savings of the measure in individual houses.

(7) The measure must not present a significant safety, fire, or health hazard when properly installed.

DOE will only consider the addition of generic "measures," not of specific products. That is, a "measure" is a class of products defined by their function, such as "insulation" or "thermal doors."

We have considered allowing States to propose additions to the lists of measures as part of their State Plans, subject to approval by the Secretary. However, since NECPA requires that such additions be made by rule, this alternative would be very cumbersome. Therefore, any additional measures which a State wishes to include in its initial State Plan should be discussed in comments on the Proposed Rule. We seek comments concerning additional measures and concerning our described criteria for additional measures.

Section 215(a)(4) of NECPA requires utilities to provide to eligible customers information on "energy conservation techniques, including suggestions developed by the Secretary, such as adjustments in end use patterns and modifications of household activities which can be employed by the residential customer to save energy and which do not require the installation of energy conservation measures (including the savings in energy costs that are likely to result from the adoption of such suggestions)."

In the Proposed Rule, DOE uses the term "energy conserving practices" in place of "energy conservation techniques." The practices included in the RCS Program (defined in § 456.104) are:

—Changing furnace and air conditioning filters.

—Installing flow restrictors in shower heads and faucets.

—Sealing leaks in pipes and ducts.

—Installing low-flow shower heads and faucets.

—Setting back thermostats at night in winter.

—Setting up thermostats in summer.

—Reducing thermostat settings on water heaters.

—Closing vents, valves and doors in infrequently-used rooms.

—Reducing average thermostat settings in winter.

The practices were included because:

(a) They save energy;

(b) They have minimal or no cost (less than $20); and

(c) They can be installed or practiced independently of the suggested measures.

The Proposed Rule allows the Governor in a State Plan to add practices meeting these criteria to this list at his discretion. This will enable a Governor to promote those practices which may have particular application to a particular climate zone or construction type.

DOE believes that many energy conserving practices are at least as effective as installing measures which require a much greater investment. It is therefore appropriate to combine information on the practices and the suggested measures in the energy audit and the Program Announcement.

"State Plans" and "Nonregulated Utility Plans" are defined as meeting requirements stated in Subparts B and C for State Plans and Subpart D for Nonregulated Utility Plans in the proposed rule.

The definition of "participating home heating supplier" reflects the voluntary participation of home heating suppliers and the Governor's choice on whether to include home heating suppliers in the State Plan, as provided in Sections 212 and 217 of NECPA.

The "Program Announcement" is the brochure which must be sent to each eligible customer to announce the availability of the RCS Program and provide information on the energy conservation and renewable resource measures. The more general term "program information" describes all the information activities undertaken by a utility or home heating supplier related to the RCS Program. Both terms describe the requirements contained in Sections 215(a) and 217(a) of NECPA. The definition of "Program information" also applies to Section 215(c)(1)(B) of NECPA regarding payment of information costs by utilities under the RCS Program.

The "program warranty" definition meets the requirements of Section 210 NECPA relating to manufacturer's warranties of measures. In writing this definition and the related definition of "useful life," see below, DOE has not used the word "manufacturer." Rather the program warranty of three years applies to any suggested measure which is supplied or installed under the RCS Program. The exact parameters of when a suggested measure is supplied or installed "under the RCS Program" is left to the State's discretion (or nonregulated utility's discretion where that utility is not included in a State Plan), but at a mini-

mum the program warranty applies to suggested measures the installation of which was arranged by a covered utility or participating fuel supplier. See § 456.305. The word "manufacturer" was omitted from the definition because it was felt that it might be ambiguous as to who the manufacturer of a given measure was. DOE believes that the statutory term was meant to include not only manufacturers of finished products away from the building site but also contractors which assemble components at the building site in order to create a "suggested measure." For example, a contractor installing a solar domestic hot water system might purchase a solar collector from a manufacturer, as well as other component parts such as pipes, fittings, etc., from other manufacturers. But the finished "measure" a solar domestic hot water system is manufactured by the contractor/installer. This finished measure must under the RCS Program have at least a 3 year warranty. Where a finished measure is merely installed by a contractor (for example, mineral fiber loosefill insulation), the program warranty applies to the measure separate from installation, and the contractor/installer need not warrant the installation or the performance of the measure for three years. The contractor/installer in this situation, however, may only use under the RCS program mineral fiber loosefill insulation which meets the program warranty and DOE's material standards, and, of course, he must comply with the installation standards contained in DOE's rules.

The term "Residential Conservation Service (RCS) Program" is used in a generic way to describe the programs of utilities and fuel suppliers established pursuant to an approved State Plan, Nonregulated Utility Plan, or a Federal Standby Plan.

"Suggested measures" are called for in Section 212 of NECPA, which requires the Secretary to identify by rule those energy conservation and renewable resource measures which are appropriate to specific climatic regions and building categories. This term is discussed at greater length below in IV. Subpart C Content of State Plans.

The term "useful life" is used to further define "program warranty" and to indicate that a product must perform the purposes for which it was designed at a level consistent with those purposes.

## III. Subpart B Procedural Requirements for State Plans

### A. Initial Submission, Lead Agency, and Coverage of State Plan

Section 456.202 of the Proposed Rule requires that, if the State intends to submit a State Plan, then the Governor or State agency specifically authorized by State law to submit a State Plan must inform the Secretary within 30 days of promulgation of the final rules of the name and address of the State Agency which will have principal responsibility for the development of the State Plan. This provision will enable the Secretary to provide technical assistance to the appropriate persons in the State, and inform the Secretary of the State's intentions.

Section 212(c)(2) of NECPA permits a Governor to include nonregulated utilities in a State Plan at the Governor's option. DOE has interpreted that language to mean that if the Governor includes any of the nonregulated utilities in the State Plan, then the Governor must include all of them. DOE believes that this interpretation would produce less of an administrative burden for the State and would also eliminate any possible unfair discrimination by the State among nonregulated utilities. Section 456.202(b) reflects this interpretation. It also reflects the requirement of NECPA (Section 212(c)(2)) that the Governor notify the Secretary of his decision to include or exclude nonregulated utilities within 30 days of promulgation of the final rules.

It was Congress's intent, as expressed in the Conference Report on NECPA, not to permit the Governor to regulate the rates of nonregulated utilities by reason of their inclusion in a State Plan. Therefore, whether included in the State Plan or not, nonregulated utilities retain the authority to establish their own rates.

Section 212(c)(3) of NECPA gives a Governor discretion to submit a plan applicable to home heating suppliers. Section 456.202(c) of the Proposed Rule requires the Governor, within 90 days of promulgation of the final rules, to inform the Secretary if home heating suppliers will be included in the State Plan. To give affect to the intent of Congress to encourage a unified State effort, § 456.206 of the Proposed Rule requires that, if the Governor elects to submit a plan for home heating supplies, the plan must be part of the State Plan and be submitted according to the same procedures for submitting the State Plan. The mechanism for coordinating this plan with other elements of the State Plan is left to the discretion of the Governor.

### B. Coordination and Notice Requirements

Section 456.203 contains two requirements for coordination in the development of the State Plan. Subsection (a) requires the Lead Agency to coordinate the Plan with neighboring States which have jurisdiction over any covered utility or participating home heating supplier subject to the Plan. Subsection (b) requires the Lead Agency, if such agency is not the State Regulatory Authority, to provide a copy of the Plan to such Authority 30 days prior to the public hearing required by § 456.204. In every State, regardless of who is the Lead Agency, the State Regulatory Authority will have a significant role to play in the implementation of utility programs. The purpose of Subsection (b) is to emphasize DOE's interest in cooperation between State agencies in the development of the Plan.

Section 456.204 carries out the requirements of Section 213(a)(7) of NECPA that the State hold hearings on the State Plan. We expect that States will consult very early with utilities, home heating suppliers, consumers, contractors, lenders, and others in the development of the Plan. Because NECPA allows only six months for the development of the State Plan, we decided not to include in the Proposed Rule any prescription of the specific groups which must be consulted or the schedule for their consultation. We invite comment on whether these provisions are adequate to ensure public participation in the development of the Plan.

### C. Submission and Approval of Plans

Section 456.205 contains the schedule for development, submission, approval, and possible disapproval of the State Plan. For the most part, this section repeats the requirements of Section 212(c)(1) of NECPA. Paragraphs (c)(2) and (3) require the Lead Agency to notify the covered utilities and participating home heating suppliers of the approval of the State Plan by the Secretary, to direct their compliance with it, and to certify their compliance to the Secretary within six months. Subsection (e) provides for States to submit amendments to the State Plan to the Secretary. Such amendments shall be considered according to the same procedures and schedule as the original Plan.

### D. Tennessee Valley Authority

NECPA gives the same authority to the TVA as it does to both a Governor and a State Regulatory Authority, with respect to those utilities over which TVA has ratemaking authority. This creates the problem of overlapping jurisdictions in those States where the TVA-regulated utilities are located. Section 456.207 of the Proposed Rule contains the few provisions necessary to clarify the role of the TVA. In particular, we expect the TVA to cooordinate the development of its Plan closely with the Plans of the States in which its utilities are located. We seek comment on additional provisions which may be required to reduce

the potential for conflict or duplication of such Plans.

#### E. TEMPORARY PROGRAMS

Section 218 of NECPA provides an opportunity for States and utilities to develop programs which do not meet all the requirements of Sections 215 and 216(a) of the Act, if such programs meet certain general requirements enumerated in Section 218. Section 456.207 of the Proposed Rule is based on this Section of NECPA. It permits the Secretary to approve a request for a temporary program for a period not to exceed 3 years from the date of approval. The Secretary may approve a temporary program for three years but may, upon review, disapprove the continuation of the temporary program if it has failed to achieve its required goals.

DOE has not added requirements for approval of a temporary progam to those in NECPA since DOE believes that the temporary program requirements as stated in NECPA are sufficient at the present time. Therefore, if the Governor or public utility can demonstrate that such a program will achieve the same or a greater level of installation of suggested measures without adversely affecting price, interest rates or competition, a temporary program is likely to be approved.

DOE recognizes, however, that there may be a need to add requirements to the proposed rule which will improve the ability of the Department and/or the public utility or Governor to monitor the temporary program or ensure a transition to a regular RCS Program at the conclusion of the temporary program's life.

For example, as part of the criteria for approval of temporary programs, DOE could establish specific data collection and evaluation requirements, or a phasing in of program elements to bring the temporary program into eventual compliance with the RCS Progam. We seek comment on whether these or any other additional criteria for approval of temporary programs should be added.

### IV. CONTENT OF STATE PLANS

#### EXISTING PROGRAMS

Many utilities and home heating suppliers have been offering services to their customers which are similar to those required by NECPA. NECPA, however, does not exempt existing programs from compliance with its provisions. All programs will have to offer for all suggested conservation measures: Program announcements; energy audits; lists of contractors, suppliers, and lenders; arrangements for installation and financing; and the other services and benefits of Subpart C of the rules. Therefore, all existing programs will have to be changed to come into compliance with NECPA and the various State Plans, with two exceptions described below.

The two exceptions to this general rule are:

(1) If a State law or regulation was in effect on November 9, 1978, which required or explicitly permitted a utility to sell or install measures or to make loans for the purchase and installation of measures, then the utility may continue those specific activities without change. However, DOE's interpretation of this provision of NECPA (see Subpart E of this Proposed Rule) would still require such a utility to offer all the services required to be in State Plans with respect to all suggested measures (see Subpart C). This interpretation is further explained and elaborated upon below in "E: Supply, Installation, and Financing by Utilities." It should be noted that if an existing utility program of any kind was not required or explicitly permitted by an existing State law or regulation, that program must meet all the requirements of Subpart C, unless the exception below is utilized.

(2) A State or a utility may petition the Secretary for a temporary program, which the Secretary may approve for a duration of no longer than three years, subject to periodic review. Under such a temporary program, a State or utility may be exempted from many of the requirements of these rules for up to three years. In order for the Secretary to approve such a request, the State or utility must demonstrate, among other things, that as many suggested measures would be installed under the temporary program as would be installed under a program meeting the requirements of Subpart C. This provision is § 456.207 of these rules, and is discussed above in "III. E: Temporary Programs."

#### B. INVESTIGATION AND ENFORCEMENT

Although any State Plan not adequately implemented may be replaced by a Federally imposed plan enforceable by the Secretary, see Subpart F, responsibility for enforcing an existing State Plan rests with the State. Section 213(a)(1) of NECPA provides that no State Plan shall be approved by the Secretary unless it contains "adequate State enforcement procedures * * *." The Conference report emphasizes that enforcement of the State Plan is a State responsibility and that State Plans should contain adequate enforcement procedures before being approved by the Secretary. Therefore, before granting approval, DOE intends to carefully scrutinize State enforcement procedures.

The Proposed Rule permits the State to be flexible and creative in designing a means of enforcing the State Plan. However, the State must show that its proposed enforcement procedures are adequate and fully capable of implementation. For example, if the State decides to delegate enforcement responsibility over some or all utilities to a local municipality or a State Regulatory Authority, it must state its reasons for delegating the responsibility, the legal authority of the municipality or Authority for carrying out enforcement of the State Plan, the resources which will be made available by the municipality or Authority, the actions the State will take to review the adequacy of enforcement by the municipality or Authority, what the State considers to be adequate enforcement, and what action the State will take if the municipality or Authority fails to enforce the State Plan adequately. The State must explain whether the State Plan will be legally enforceable through existing State law or, if not enforceable under existing State law, what legislation the State proposes to make the State Plan enforceable, and when passage of such legislation is anticipated. The State must also describe the inter-relationship between existing and proposed State and local laws which may affect the enforcement of the State Plan and explain how these laws will be enforced so as to be consistent with the enforcement of the State Plan. Status reports of any pending legislation pertinent to State Plan enforcement procedures will be required through Section 456.318.

Section 456.303(b) provides that State Plans must require utilities subject to the Plan to petition the Assistant Secretary for Conservation and Solar Applications in accordance with § 456.102(a) whenever a utility believes that it is prohibited by a State or local law or regulation from taking any action required by NECPA, the State Plan, or any rule promulgated pursuant to NECPA, or that it is permitted or required by a State or local law or regulation to take any action prohibited by NECPA, a State Plan, or any rule promulgated pursuant to NECPA. As explained above with reference to Subpart A, Section 220(2) of NECPA states that NECPA does not supersede any State or local law or regulation except upon a determination of the Secretary that a conflict exists.

DOE has received several inquiries as to the meaning and effect of this provision of NECPA. The legislative history indicates there was concern that, because of the scope of NECPA and its mandated RCS Program, many areas of State and local law might be affected. Section 220 was, therefore, intended on the one hand to assure that NECPA would not supersede any State or local laws or regulations unless the conflict between them was

irreconcilable, and on the other hand to require that determination of irreconcilability be made by the Secretary (or his delegate) rather than by the various State officials or utilities. Section 220 provides that such determinations will be made upon petition of a covered utility because it was believed that, as the action agents of the RCS Program, those utilities would identify, and be most affected by, conflicts between NECPA and State and local laws and regulations.

The drafting of Section 220 of NECPA does not make explicit that utilities *must* petition the Secretary when they believe a conflict exists, but the legislative history is clear that there was no intent to allow utilities to avoid the mandates and prohibitions of NECPA or rules or Plans promulgated thereunder by merely failing to petition and then claiming they are bound by State or local law or regulation. Accordingly, DOE has in § 456.303(b) of the Proposed Rule required State Plans to require utilities subject to a Plan to petition the Assistant Secretary whenever they believe State or local laws or regulations directly conflict with their duties and prohibitions under NECPA. Nonregulated Utility Plans must contain the same requirement for the nonregulated utility, and any Plan issued under Federal Standby Authority will contain the same requirement. DOE believes such a requirement is necessary to assure that NECPA is adequately implemented.

### C. EXEMPTION AND WAIVERS FOR UTILITY SUPPLY, INSTALLATION AND FINANCING

Subpart E of this Proposed Rule prohibits supply, installation, and financing of suggested measures by utilities except in certain exempted situations. Subsection 456.304 (b) and (c) requires the State Plan to describe these exempted activities which will occur in the State and how they will meet the requirements of the State Plan. Subsection (a) clarifies that any covered utility which supplies, installs or finances measures must be included in the lists of such firms in the same way as other suppliers, installers, and lenders.

Subsection (d) contains provisions regarding fair and reasonable prices and interest rates, and the prevention of discrimination, which are contained in Section 213 (a) and (b) of NECPA. Paragraph (d)(1) requires a State agency to review the prices and interest rates charged by utilities. We considered ways of setting standards for "fair prices and interest rates." This paragraph requires the State agency simply to compare the utilities' prices or interest rates with other prices and interest rates charged in the local area for similar services. We seek comment on this provision.

### D. SCOPE OF BENEFITS

In developing this Proposed Rule, we frequently confronted the problem of defining which customers in a State are eligible for which of the services and benefits offered under the State Plan. NECPA clearly requires certain services to be offered to every person defined as a residential customer. These include Program Announcements, on-site energy audits, arrangements for installation and for financing, and lists of suppliers, contractors and lenders. In addition, NECPA requires that a procedure for redress be established for any person alleging any injury as a result of violation of a State Plan. But eligibility for several other services or benefits is not clearly defined in NECPA. In particular, the applicability of the standards for materials and installation is ambiguous, as is eligibility for the procedures for resolving complaints against contractors and suppliers.

The Proposed Rule uses the term "eligible customer" to refer to the broad group of people who must be offered the basic services of the program: The Program Announcement, auditing, arranging, and lists. But the State must define what "eligible customers" must do to be assured that they can take advantage of other benefits established by the State Plan. These benefits, defined in § 456.305(a), are the following assurances:

(1) That the suggested measure purchased by the customer will be covered by a program warranty;

(2) That the suggested measure installed in the customer's home will meet DOE's installation and material standards, and the suppliers, contractors, and lenders who appear on the State lists will perform according to the listing criteria of § 456.312 for that installation;

(3) That the installation will be included in the pool of installations from which random inspections of compliance will be chosen, and with respect to installation of certain measures, that the installation will be subject to a mandatory safety inspection;

(4) That the customer is eligible for the billing and repayment services of the utility or home heating supplier; and

(5) That any complaints which the customer has against the installer, supplier, or lender will be handled through the complaints resolution procedure described in the State Plan.

Subsection (b) sets a minimum criterion of eligibility for this group of services and benefits, which is that any eligible customer who has the installation of a suggested measure "arranged" by the utility (however "arranged" is defined by the State, utility or fuel supplier) must then be assured these services and benefits. States may establish broader criteria for eligibility for these services and benefits.

In addition, any eligible customer who has the utility "arrange" financing (however the State, utility or fuel supplier chooses to define "arranging") for the supply or installation of a suggested measure must be assured that he or she is elibible for the billing services of the utility and that any complaints against the lender may be handled through the complaints resolution procedure described in the State Plan. We seek comment on these provisions of the Proposed Rule.

We considered prescribing a broader coverage of the benefits and services. The "arranging" service which we have chosen is probably the narrowest criterion available. That is, more customers are likely to request energy audits or receive lists of contractors and lenders than will ask for the arranging service. Three examples illustrate alternative requirements which DOE considered:

(1) *Applicability of the standards for materials and installation.* We considered requiring (and a State Plan could under the Proposed Rule require) either of the following as part of the criteria for listing of contractors:

(a) Every contractor who wished to be listed would agree to meet the standards for every customer who contracts their firm through the list obtained from the utilities.

(b) Every contractor on the lists would agree to meet the standards for every customer who had an energy audit performed.

With both of these alternatives, either the contractor would have to ask the customer, the utility or the fuel supplier whether the customer was part of the program, or the utility or fuel supplier would have to provide this information to the contractor. This requirement would be burdensome and difficult to enforce. On the other hand, a customer who receives the lists from the utility and is told that there are standards for materials and installation may assume that each listed contractor would meet these standards in every case, unless there is a clear disclosure to the contrary.

(2) *Inspections.* DOE believes that random inspections of installations are essential to enforcement of the material and installation standards. Each of the two alternatives listed above for applicability of the standards could also be used as a universe from which the random inspections are selected.

(3) *Complaints Resolution Procedures.* The Proposed Rule requires that any customer who has the installation of a suggested measure ar-

ranged by a utility must have access to the complaint resolution procedures. However, we considered requiring (and a State Plan could require) that any consumer who has a complaint against any contractor who appears on the lists must be eligible for the procedures. Or, any consumer who has a audit provided by the utility could be eligible.

### E. SUGGESTED MEASURES AND CATEGORIES OF BUILDINGS

(1) *General Approach.* NECPA requires that our rules designate "suggested" measures by climate zones and categories of buildings based on construction type and other factors we find appropriate. These "suggested" measures must be drawn from the lists of energy conservation and renewable resource measures. The Secretary is given broad authority to determine what criteria are appropriate for designating suggested measures.

The suggested measures are the focus for many program activities. The Program Announcement must address the suggested measures for each category of buildings to which it is sent. Covered utilities and participating home heating suppliers must offer, and perform on request, an energy audit which covers the suggested measures for the home of the requesting customer. Thus, the suggested measures lists help establish the scope of the Program Announcement and the energy audits which utilities and home heating suppliers must offer.

We have used several criteria in developing these lists. These include:

(1) Ability to save energy.

(2) Potential to recover cost within useful life through energy savings.

(3) Commerical availability.

(4) Effect of other Federal activities (such as low-interest loans and tax credits).

(5) Effects on other State Energy Programs.

(6) Department of Energy policy regarding commercialization of renewable resources.

For each energy conservation and renewable resource measure, our principal criterion was cost-effectiveness over useful life. That is, for each measure, the first step in our analysis was to evaluate whether the measure, when installed in a typical house, would reduce energy costs enough over its useful life to pay for its purchase and installation. We used the 1978 energy prices within each State for each fuel. Future energy prices were assumed to rise at the rates predicted by computer simulations prepared in 1979 by the Energy Information Administration of the Department of Energy. The discount rate of future savings and the general inflation rate where both set at 0%. The useful life of most measures was assumed to be 20 years, though some measures were assumed to have useful lives of 10 years or less. Weather data from NOAA were used for heating degree days, cooling degree days, average temperatures, solar insolation, and wind velocities.

We considered two alternatives to our principal criterion of cost effectiveness within useful life. First, we considered designating a measure as "suggested" if it paid for itself in six years or less. Second, we considered, instead, calling a measure "suggested" if it simply saved non-renewable energy in typical buildings, regardless of cost-effectiveness. We rejected the first alternative because DOE encourages people to invest in energy-saving devices with payback periods of more than six years. We rejected the second alternative because we believe that many people would consider the RCS Program wasteful if it included many measures which do not return their cost within their useful lives.

We had two goals in developing these lists: (1) To keep the cost of energy audits low, as required by Section 210(16) of NECPA; and (2) To encourage consideration by homeowners of as many effective measures as possible, without including measures in the audits which many homeowners would find useless. We have included suggested measures, such as replacement oil burners, whose effectiveness depends on factors which only a trained auditor can determine in an individual house. We have avoided "suggesting" measures which are likely to be effective in only a small fraction of the homes in a particular State or climate zone.

The determination of appropriateness of a measure, or even of its cost-effectiveness, depends a great deal on factors which vary substantially from house to house. Therefore, it is potentially misleading for DOE to call a measure "suggested" because it may not be valuable at all in a particular home, depending on specific factors in that home. Conversely, it is also misleading for DOE not to designate a measure as "suggested" in a particular location if it is valuable in a large fraction of that area's homes. Since the principal legal effect of the designation of "suggested" is to require utilities to offer on-site inspections of that measure, our lists include more measures than they would if strict cost-effectiveness were our only criteria. Also, in choosing the "typical" conditions to use in determining cost-effectiveness, we have generally chosen conditions which are favorable to the measure.

With most suggested measures, we faced the problem of choosing which type of that measure to assume in performing calculations, for example, choosing between wood-, aluminum-, or vinyl-framed storm windows. For most measures, though, the energy-saving performance of the various types is substantially the same. For example, adding R-19 ceiling insulation saves the same amount of energy whether it is cellulose, fiberglass, vermiculite, or any other type. While the cost of the different types may vary, competitive products generally have competitive prices. Thus the particular choice of type of measure did not significantly affect the calculations in most cases. Where there existed a substantial difference in price, for example, vent dampers and replacement oil burners, we chose types which are commonly used or available and are of high quality. For each suggested renewable resource measure, a system was chosen for which performance estimates are available and which is representative of high quality products which are commercially available. Passive solar devices presented a particular problem, since the types of passive devices have substantially different characteristics. As explained below under "(2): Categories of Buildings" and "(4) Suggested Renewable Resource Measures," we have designated passive devices as suggested for all locations and housing types.

For certain measures, we assumed installation by the homeowner, in determining the cost of the measure, for purposes of measuring cost-effectiveness. These included caulking and weatherstripping, water heater insulation, ceiling or attic insulation, floor insulation, duct insulation, reflective or absorptive films, and clock thermostats.

The detailed information used in the calculations to determine the suggested measures is available in the public docket for the Proposed Rule.

(2) *Categories of Buildings.* Section 212(b)(1) of NECPA requires the Secretary to determine the categories of residential buildings by which measures are "suggested." These categories are to be determined "on the basis of type of construction and any other factors which the Secretary may deem appropriate." These categories have two principal effects in the program: (1) The Program Announcement distributed to any customer by a utility or home heating supplier must list the suggested measures for the category which includes the building owned or occupied by that customer. It must also state the energy cost savings of each suggested measure installed in a typical building in such category. Thus, for example, if we establish three categories which affect a particular utility, that utility must either be able to divide its customers into those three categories and send a separate

announcement to each, or distribute the same announcement to all customers, showing the suggested measures and their savings for each of the categories. (2) Similarly, a utility or home heating supplier must offer to each customer an energy audit of each measure "suggested" for the category of building in which the customer lives.

The complexity of these requirements in NECPA strongly indicates that our categories should address only those factors which grossly affect the appropriateness of each measure. Section 456.306(b) contains our proposed categories. We have found that the appropriate factors for establishing categories vary between classes of measures. We seek comment on the effect and validity of the categories we have chosen.

Paragraph (b)(1) establishes the categories for all energy conservation measures. Since cost-effectiveness is the principal criteria by which we analyzed measures, we evaluated those factors which affect cost-effectiveness. We found that construction type, such as "ranch-style" or "Cape Cod", is virtually irrelevant to cost-effectiveness of conservation measures. The factors which were most important were: (1) Type and cost of heating fuel; (2) presence of air conditioning; (3) climate; and (4) the characteristics of the relevant construction components of buildings, such as whether the walls are solid brick or wood frame, or whether the floor is a concrete slab on grade or a wood floor over a basement.

We have included part of the first factor, type of heating fuel, as the sole determinant of building category for energy conservation measures, because it so strongly influences cost-effectiveness and is simple for a customer to identify. The second factor, presence of air conditioning, was included or excluded as a characteristic of the houses which we simulated, depending on the climate zone. That is, in climate zones with substantial cooling requirements, we assumed the simulated house had air conditioning in evaluating the cost-effectiveness of each conservation measure. The third factor, climate, is a principal division of the lists of suggested measures in addition to (and separate from) categories of buildings. Finally, the fourth factor, characteristics of construction components, was rejected because of the substantial complexity it would add to the categories. Consideration of this factor would require separate categories for each conservation measure, and substantially increase the complexity of Program Announcements which a customer would receive.

A similar analysis of appropriate factors was performed for each renewable resource measure. We found, however, that we could not avoid establishing separate categories for renewable resource measures. Paragraph (b)(2) establishes water heating fuels as the categories for determining whether or not Solar Domestic Hot Water Systems will be suggested. Though total hot water consumption is also a crucial determinant of cost-effectiveness, this factor was not used since it is more easily considered by the on-site auditor rather than by our rules.

Paragraph (b)(3) establishes three categories for active solar heating systems. These categories also apply to combined active space heating and hot water systems. We evaluated the characteristics of twelve building types and their effect on these measures. We found that, in general, the most important determinant of cost-effectiveness of these measures in a building at a particular location is total heating load. The three categories we have established are broadly representative of the size of heating requirements, and are also readily recognizable to the average customer. We invite comment on the effect and correctness of this decision.

Paragraph (b)(4) establishes one comprehensive category for passive solar devices. Though many construction characteristics greatly affect the appropriateness of this measure, the great variety of passive devices and their characteristics require that either we establish a complex set of categories for the various passive devices, or that we establish only one category and leave the determination of appropriateness to the on-site auditor. We seek comment on our decision.

Paragraph (b)(5) also establishes one comprehensive category for wind energy systems. Construction type is much less relevant to evaluating wind systems than is cost of electricity or average wind speeds. As described below we have assumed in evaluating wind systems by climate zones that adequate siting is available for a wind system. We seek comment on our decision.

Finally, paragraph (b)(6) establishes simple and relevant categories for solar pool heaters. We expect that where solar pool heaters are suggested measures, Program Announcements will simply show what the energy cost savings are for a pool with each fuel used in that area for pool heaters.

(3) *Suggested Conservation Measures.* The lists of suggested conservation measures are divided by States and climate zones. They are divided by States for the convenience of interested persons as well as for those who will write plans and implement programs, and because the lists are based on fuel prices which vary by State. There are ten climate zones. They are the same as those developed for DOE's Building Energy Performance Standards, except that additional zones have been created to account for finer divisions of air conditioning requirements.

We used two computer simulation models to perform analyses of cost-effectiveness. The first, called "Updated Project Conserve", determines the changes in heat loss through the envelope of a building (i.e., wall, windows, ceiling, etc.) due to the addition of insulation, window modifications, and caulking and weatherstripping. The second model, developed especially for the task of suggesting measures, analyzes the effect of changes in heating system efficiency and duct insulation. This second model also evaluates interactions between the savings resulting from measures when they are installed in combination. In developing the list of suggested measures, however, a complete analysis of all possible interactions was not performed.

We believe that these two models are substantially accurate in evaluating energy savings for all suggested measures. We continue, however, to examine the usefulness of more sophisticated simulations, particularly with respect to window systems. We invite comment on the accuracy and appropriations of our approach.

Though the fuel prices and climate assumptions we have used vary widely across the United States, and these variances have been incorporated into our calculations, we have used a single cost of purchase or installation for each conservation measure. This is due to the cost to DOE of collecting accurate purchase and installation price information by State or region. Also, we have found that the price of many measures varies as much within any geographic area as it does between areas. We seek comments as to the accuracy and effect of our price assumptions.

*Water Heater Insulation.* The categories of buildings for conservation measures (i.e., space heating fuels) are not directly relevant to the cost-effectiveness of water heater insulation. What is relevant is the location and model of the water heater and the fuel it uses. We have assumed favorable location and model in our simulation. And we have further assumed that the water heating fuel is the same as the space heating fuel. This assumption is supportable because Census Bureau construction data indicate it is true for a majority of houses. In any case, water heater insulation appears to be cost-effective with respect to most fuels in most parts of the country. We seek comment on our approach to this measure.

*Replacement oil burners.* This measure is suggested for all oil-heated homes in every part of the country.

Our alternative was to select categories of oil-heated buildings in which replacement of burners is cost-effective and designate burners as "suggested" only in such buildings. However, two important determinants of the cost-effectiveness of a replacement oil burner, the quality and the efficiency of the existing burner, are unknown without an efficiency test by a trained auditor. Therefore, we have designated oil burner replacement as a suggested measure in every oil heated home in order to assure that a test of the efficiency of oil furnace is a part of an audit in every oil heated home.

However, this approach has an important drawback. It implies that the Department of Energy "suggests" replacing the burner in every oil furnace in the country, which is incorrect. Many, and perhaps most, oil furnaces can be made and kept efficient through steps much less costly than burner replacement. These steps include adjustment of nozzle size, cleaning and tuning, and replacement of parts (but not all) of the burner. We considered including these steps as "energy conservation measures", but NECPA (Section 210(11)) requires that such measures be warranted by manufacturers for at least three years. It is possible that repalcement parts could meet this criterion, and we are considering adding this step to the list of measures. We are also considering expanding the definition of "energy conserving techniques" to include annual cleaning and tuning of oil furnaces. We would, however, like to require a thorough inspection of an oil furnace by a trained technician as part of every audit of oil heated homes. We seek comment on the correctness and effect of this treatment of oil furnaces in the Proposed Rule, especially with respect to what impact this treatment has on the cost of audits for oil heated homes.

*Flue opening modifications.* We have defined this term to include only vent dampers, and propose that it be a suggested measure for every gas or oil heated home in the country. As with oil burner replacement, this approach has the drawback of implying that DOE "suggests" installation of vent dampers in all such homes, which is incorrect. However, each of the factors which affects the cost-effectiveness of vent dampers is difficult to take account of in our lists. Though location and configuration of the furnace are essential factors in computing cost-effectiveness, their use would require that we establish a special set of categories for vent dampers. Also, the auditor can easily and most readily evaluate these factors and advise the customer of the appropriateness of a vent damper. In addition, we are considering prohibiting installation of a vent damper on furnaces in unheated spaces as a part of our required installation standards because in such circumstances they do not save energy.

Another relevant factor for determining the cost-effectiveness of vent dampers is the total size of the heating bill. The savings from installation of a vent damper is a fixed percentage of the total fuel bill. This percentage is approximately the same for all furnaces with the same characteristics in any given climate. Thus, we could determine the minimum size of the fuel bill needed to assure cost-effectiveness, and establish two categories of buildings for vent dampers: (1) Those with fuel bills over the minimum, for which vent dampers would be suggested; and (2) those with fuel bills below the minimum, for which vent dampers would not be suggested. However, these categories would complicate the Program Announcement, would change if a customer took other steps to reduce fuel use, and are hard to use for customers who use their heating fuel for other purposes and receive only one billing from their utility or fuel supplier. We seek comments on our decisions regarding vent dampers, and on alternatives.

*Load management devices.* This measure is suggested for all buildings serviced by an electric utility which offers load management rates. The categories of buildings by which it is suggested are the same as for other conservation measures, but the geographic and climatic zones are irrelevant. We have performed no analysis of cost-effectiveness for this measure. We seek comment on the effect of this treatment of load management devices.

(4) *Suggested Renewable Resource Measures Wind Energy.* The economic effect of using wind energy for residential buildings was assessed on a region by region basis, using a computer process prepared for this purpose. We used performance data for a model wind system which is representative of a class of high-performance, low-cost, small wind energy conservation systems. We originally used NOAA-provided wind data for the region and computed the average energy that would be generated in a typical year by the model wind system operating in the NOAA-wind regime. The cost of the wind system was then compared with the cost of the energy delivered to the residence, to ascertain if the wind system will save enough to return its cost within its useful life. The economic analyses were performed using electricity as the displaced non-renewable energy.

The analyses resulted in very few regions demonstrating sufficient economic benefits to justify the investment in a wind system. But, since the NOAA-provided wind data was obtained predominantly at airports which are usually in the calmer portion of each region, we "enhanced" the NOAA-provided wind data. That is, the wind regime was shifted by 40% to increase the intensity of the wind used in each analysis to reflect the potential for greater winds at the customer's residence than at the NOAA data site. The economic analysis was repeated using the enhanced wind data. A number of regions were identified as areas in which wind energy would be economically attractive. We used the enhanced wind data results in the Proposed Rule.

Consideration was given to further expanding the geographic scope of wind energy suggested measures. This possibility was rejected, however, because it might substantially increase the number of wind audits requested, due solely to the DOE finding of potential economic application. The cost of providing those audits would be unduly burdensome on the utilities, fuel suppliers, and their customers because few such audits would provide positive results to the customer. DOE solicits comments on this decision.

*Solar Space Heating.* The use of solar energy to heat a residence is currently expensive, relative to the non-renewable energy saved. The difficulty of finding situations in which solar space heating was cost-effeective was confirmed by computer analyses comparing solar-collected energy with electricity as the non-renewable energy to be displaced. Very few combinations of electricity cost, insolation, climate and heating load resulted in a positive determination. Other non-renewable fuels are generally less costly than electricity; thus their potentials for economic replacement by solar energy for space heating is lower than that shown by electricity. As a result, solar space heating is a suggested measure for only a few locations and categories of buildings.

*Passive Heating and Cooling Systems.* Passive heating and cooling implies the use of natural forces in the environment—including solar insolation, orientation, winds, night-time coolness, and the opportunity to lose heat by radiation to the night sky—to heat or cool a building. Normally, this heating or cooling is done without the support of mechanical means to transport the thermal energy. Rather, it is an integration process to utilize natural forces for human comfort within a man-made environment. (It is intended, however, that so-called hybrid systems that make limited use of small fans to move air from storage to use are included within this definition.) The performance of some passive systems can be enhanced significantly by the cooperative behavior of the struc-

ture's occupants. Moreover, it is plausible to install more than one solar measure in a structure. More than one passive measure can be installed, as can more than one active measure; active and passive measures can also be installed in combination.

There are many techniques and design concepts which can make effective use of the environment for residential building heating and cooling. The cost of introducing a particular passive solar measure into an existing residential structure is significantly dependent upon the design and construction of the particular structure. The energy-saving effectiveness of a passive measure is a reflection of the design and construction of the measure, itself, of how the structure's occupants live with the measure, of the orientation of the structure with respect to the sun, shade trees, other structures and prevailing winds, of steps taken or provision made to retain the collected heat or coolness once collected and, most importantly, of the local climatic conditions. Thus, particular conditions of a structure, its design and occupants, climatic location and its siting are dominant in determining the economic applications of passive measures.

Passive measures of some kind can be appropriately applied in any climatic region, if the measure is properly matched to the structure, the site and the local climate. Thus, passive solar measures are suggested measures for all regions and housing types.

We solicit comments on this approach, particularly with respect to the effect it may have on the cost of audits, as well as the difficulty of dealing with the variety of types of measures in the Program Announcement and the energy audit.

*Domestic Hot Water (DHW).* It was determined that solar heating of domestic hot water should be a suggested measure to replace any non-renewable fuel type for any climatic region of the country in which it economically displaces at least one non-renewable type of fuel. That is, if solar heating of hot water is found to be an economic investment in a region when it replaces any fuel, it is suggested for application in that region for all fuels.

The first step in this determination was to perform a computer analysis of the cost and savings of solar DHW for all climatic regions and displacing all types of non-renewable fuels. A high-quality solar system was used as the basis for this assessment, as were insolation and climatic data representative of each region, and average fuel costs for the State. An average family size with average hot water needs was considered by the computer analyses.

The computer analyses showed solar DHW to return its cost, using electricity as the displaced fuel, in most regions; the principal exceptions were the Pacific Northwest and those regions served by the TVA. Solar DHW appears to be economically viable as an alternative to natural gas in only a very few regions. It appears to be economically attractive compared to oil in more regions than natural gas and less than electricity.

Solar DHW is one of several technologies which DOE has chosen for a special marketing effort as part of our "Commercialization" program. We wish to increase the public's consideration of these devices. In addition, with other energy conservation and renewable resource measures, the assumptions we make in the computer analyses are not likely to be appropriate for all customers in the affected regions. For example, there are customers with natural gas water heaters whose hot water usage is high enough to justify a solar system, even though solar systems are not attractive for the average family in that location. We have therefore decided to include solar DHW as a suggested measure in a region if it appears economically attractive with respect to any fuel.

This decision furthers DOE's commercialization goals by requiring utilities to offer audits of solar DHW to all customers if it appears economically attractive for an average family in that region using any fuel. That is, for example, audits of solar DHW will be required to be offered to customers whose hot water is heated by fuels other than electricity, even though in that area our computer analyses showed solar DHW to be cost-effective only against electric hot water systems. We seek comment on the effects of this decision. In particular, we seek comment on two questions: (1) How is this decision likely to affect the cost of audits and the State's decision, allowed by § 456.307(a)(1), on whether to include solar DHW as part of the same audit with suggested conservation measures? (2) Will our decision on suggesting solar DHW have a net positive or a net negative affect on the acceptance of solar DHW? We are concerned that some customers may be put off by the results of an audit of solar DHW, if it is known in advance of the audit that such systems are unlikely to be cost-effective for that customer's category of building.

*Swimming Pool Heaters.* This measure is suggested for all categories of buildings where heated pools are present. Because of design, size, and location differences, it is not possible to model swimming pool heater applications. Several local jurisdictions are requiring pool heaters to use renewable resource energy and many comments received in response to the Advance Notice of Proposed Rulemaking indicated that solar pool heaters should be considered. We seek comment on the inclusion of this measure on the list of suggested measures.

### F. PROGRAM ANNOUNCEMENT

NECPA requires each RCS Program to include provisions to "inform" each of its eligible customers of four items:

(1) The suggested measures for the category of buildings in which the customer lives;

(2) The savings in energy costs likely to result from the installation of the suggested measures in a typical building in that category;

(3) The suggestions of energy conserving practices developed by the Secretary, including an estimate of the savings from these practices; and

(4) The availability of energy audits, arrangements for installation and financing of suggested measures, and lists of suppliers, contractors, and lenders.

DOE has repeater these requirements in § 456.306 of the Proposed Rule and has added several others described below. We have required that this information and the offers of services be included in a Program Announcement which the utility or fuel supplier sends to each eligible customer. DOE believes that this brochure should serve to motivate the customer to request the services provided under the Program. It must be sent to each customer within six months of the approval of the State Plan. We expect that, in general, these brochures will be developed by each covered utility and participating fuel dealer after the State Plans are approved.

Subsection § 456.306(a) describes the minimum content of the Program Announcement, and requires that it be sent every two years before January, 1985. Paragraphs (1) through (4) set the minimum information required about the suggested measures and about the energy conserving practices. We have considered but excluded any requirement that cost estimates be included in addition to savings estimates. If the customer does not have an audit performed, cost estimates could be important to customers in deciding which of the measures to purchase. But such estimates could be misleading and could affect prices in local markets. Also, we do not intend that the Program Announcement be a basis for investments, but only a means of motivating customers to seek further services. We seek comment on whether costs should be included in the Program Announcement.

The savings estimates are to be expressed in dollars because we believe that this is the best form to use in motivating customers to take action, and because this is the most literal interpretation of the statute. We invite

comment on whether percentage savings estimates ought to be allowed in place of dollar savings estimates. (It should be noted that the proposed Rule would allow percentage savings estimates as an addition to the dollar savings estimates.)

We considered prescribing substantially more information to be included in the Program Announcement, but decided to leave these items to the discretion of the States or the utilities, as determined in the State Plan. Among the items we considered but did not include in the Proposed Rule are:

(1) The simple payback period of each measure;

(2) The expected useful life of each measure;

(3) An estimate of the total savings likely to result if all suggested measures were installed in a house which had none of the measures to start with (this total would be less than the sum of the individual savings);

(4) A requirement that the suggested measures be listed in order of their simple payback periods;

(5) Other more complex measures of cost-effectiveness for each measure.

In general, we rejected each of these for two reasons; first, as stated above, the principal purpose of the Program Announcement in our view is to motivate the customer to request further services, rather than to serve as a guide for investing; and second, we believe each State should have the flexibility to include whatever additional information it and its utilities and fuel suppliers believe to be pertinent to their particular programs.

Paragraphs (a)(5) and (6) require the Program Announcement to include information about each of the services included in the program. We are concerned that the customer be fully aware from the outset of which program services are available under which circumstances. We seek comment on whether Paragraph (a)(6) should be modified to require a description of each of the benefits as well as the circumstances under which they are available.

Paragraphs (a)(7) requires a disclosure in the Program Announcement to the effect that the savings estimates shown are not likely to be the same as those the customer can expect in his or her own house. We believe it is critical not to mislead the customer into thinking that these estimates are more accurate than they actually are. We invite comments on the particular wording which we have included, though the Proposed Rule allows equivalent statements.

Paragraph (a)(8) requires an explanation be made by electric utilities to all customers for whom load management is not a suggested measure that they are not suggested measures for their area because they would need certain rates which are not presently available to them in order to save money from installation of load management devices. We believe it is important to make customers aware that there is a conservation potential from such devices. The Public Utilities Regulatory Policy Act (PURPA) requires each State to hold hearings on certain alternative ways of setting electricity rates, some of which would make load management devices economically attractive to residential customers. The Program Announcement is a convenient vehicle for increasing public awareness of this conservation potential. We seek comment on this provision.

Paragraph (a)(9) prohibits any advertising for any suggested measures or for any contractor, supplier, or lender, including the utility or fuel supplier itself. To allow such advertising, particularly by utilities, might adversely affect competition, and might imply to some customers an endorsement by DOE of the advertised products or firms.

Paragraph (a)(10) prohibits the addition of any information in the Program Announcement about products which are not energy conservation or renewable resource measures or energy conserving practices. To allow such information would give the impression to many customers that DOE, the State, the utility, or the fuel supplier endorsed such products, when this may not be the case. There may be advantages, however, to allowing some information of this nature, and we invite comment on the prohibition.

We consider requiring that the Program Announcement contain information about two classes of energy saving products in addition to the "suggested measures:" One would be those products which are designed to save energy but which do not save enough energy in typical houses in the utility or fuel supplier's service territory to pay for themselves over their useful lives. The second class would be those products which save energy, but which are not principally designed to do so, such as drapes and carpets. We believe that objective information about such products might be useful to customers, particularly if they were clearly separated from the "suggested measures." However, we decided against requiring or allowing their inclusion because to add too much information would divert attention from the measures we wish to emphasize and might be confusing.

Subsection 456.306(c) sets the minimum standards for the calculation procedures used in estimating the savings of suggested measures in the Program Announcement. The Proposed Rule requires that the prices on which these estimates are based be representative of those for the location of the customer. It should be possible to use typical fuel rates for the location of the customer, and to collect cost information about suggested measures which is an average of some broad geopraphic area which includes the customer's home. Paragraph (3) requires that a consistent procedure be established in the State Plan for making these estimates. In particular, if a customer receives more than one Program Announcement, the estimates in those announcements must be the same. This will require that the State develop either the estimates or the calculation procedure which the utilities and fuel suppliers use, or that there be sharing of data among utilities and fuel suppliers where service territories overlap.

We considered a much more prescriptive requirement for estimating savings of suggested measures. DOE is completing a recommended procedure for calculating and presenting the savings estimates that must be in the Program Announcement. We considered requiring that every Program Announcement use the estimates which this calculation procedure will produce, based on fuel and materials cost estimates which the States, utilities or fuel suppliers would collect immediately prior to production of the Announcement. However, we decided that many States may have their own calculation procedures which would be just as valid as that which we are developing. Our basic goal is consistency of estimates provided to an individual customer, which should be achieved by the requirements of paragraph (a)(3). We invite comment on this alternative.

We have not prescribed the type of each suggested measure which must be used in calculating energy savings. This selection will be made by the State and is a necessary part of the consistency requirement of subsection 456.306(c). We recognize that variations in types of measures can lead to inconsistencies within or between States, particularly with respect to passive solar devices. We seek comment on this problem.

We also considered prescribing other information to be included in the Program Announcement such as:

(1) Information about Federal and State tax credits for suggested measures;

(2) Information about other Federal, State and local conservation programs which the customer may be eligible for; and

(3) An offer of information about self-installation of suggested measures, for those customers who decide to install measures after reading the Program Announcement.

We concluded that it would be unwise for us to require such additional information since it might clutter up the Program Announcement and confuse customers. However, States may consider distributing such information through their programs.

Subsection 456.306(d) repeats the requirement of NECPA for an offer of services to people who become eligible customers of a covered utility or fuel supplier after the program begins. We have added a requirement that the utility or fuel supplier offer to such customers the results of any audits which have been performed on their new residences. The law requires that such results be retained for five years and be made available to new customers without charge. Our added requirement merely assures that the new customer will be aware that an audit has been performed on his or her residence.

### G. ENERGY AUDITS

NECPA requires each covered utility and participating fuel supplier to offer an on-site energy audit of the residence of each eligible customer, to estimate the cost of installing the suggested measures in that residence and the savings in energy costs which are likely to result. Such audits may be done directly by the utility or fuel supplier with its own personnel or through one or more auditors under contract. The initial offer of this audit must be made to every eligible customer within six months of approval of the State Plan. This Proposed Rule requires the Program Announcement described above to be the vehicle for this offer.

NECPA is based in part on the assumption that large numbers of people will request these audits and then make decisions based on the information they receive. DOE believes that the information provided through this audit is the central motivating force of the Residential Conservation Service Program. We also recognize that this audit is likely to be the most expensive part of the program. Our goal has been to find the right balance between assuring that audits will meet certain minimum levels of quality and leaving room for innovation by States, utilities and fuel suppliers. We have devoted a great deal of attention to this section of the rules and invite detailed comments on our assumptions and on the specific provisions in the Proposed Rule.

In developing these rules, we seriously considered prescribing the requirements for audits in considerable detail. We concluded that a less prescriptive approach was advisable. We have decided, however, to develop a model auditing procedure. We believe that this will be helpful to States which do not have their own auditing techniques available. This audit will exceed the minimum requirements of this Proposed Rule for calculations and results. We hope that it will be the basis for many of the programs run by utilities and fuel suppliers.

We have chosen to use the word "energy audit" where NECPA uses the word "inspection." We believe energy audit is the most common term used to describe this activity. However, we invite other suggestions, and realize that various States, utilities and fuel suppliers may choose to use other terms in the programs they offer to customers.

We have chosen a limited definition of "energy audit," one which is based solely on the activities required by the legislation. We have considered including two additional concepts in the definition: First, a requirement for a determination of the total heating and cooling requirements of the building in question; and second, a specification of the measures which an energy audit must address. The first concept was rejected because we do not feel it is always necessary to determine heating and cooling requirements in order to estimate costs and savings of suggested measures. The second concept was left out of the definition but included in the requirements for energy audits under the program, described below.

Subsection 456.307(a) describes the two types of audits which the utilities and fuel suppliers must offer, at a minimum, under the State Plan. Each customer must be offered two audits: one which addresses all suggested energy conservation measures and only energy conservation measures, with the possible addition of solar water heating; the other is an audit of the suggested renewable resource measures, which may at the discretion of the State be offered individually for each measure.

We believe that, by allowing utilities and fuel suppliers to offer only one complete audit of all measures, the cost of the audit would increase to such an extent that customers would be discouraged from requesting one. Our analysis indicates that the cost of an audit of the conservation measures alone would be approximately $25–$50, depending on the number of suggested measures in the locality. Adding solar water heating to this audit would not increase its cost significantly, so the Proposed Rule allows States to include them with the conservation measures. Adding other renewable resource measures, however, would have a more substantial effect on the cost of the audit, and thus we have separated these measures. (See the summary of the Regulatory Analysis below.)

We have required that all the suggested energy conservation measures, such as insulation and furnace improvements, must be included in one audit. This is because we believe that all suggested energy conservation measures must be considered together by the customers to encourage investment in the most effective measures first.

We considered two broad alternatives to this division of audits. First, we considered allowing States to decide whether to offer only one audit which covered all suggested conservation and renewable resource measures. This type of audit is the most literal interpretation of the statute. Second, we considered allowing States to divide the audits into whatever pieces they or the utilities and fuel suppliers found appropriate, or even to allow the eligible customers complete discretion in deciding which measures he or she wanted analyzed. We have rejected each of these two approaches in favor of that contained in the Proposed Rule, but seek comment on these alternatives.

NECPA prohibits a utility from being required to conduct more than one inspection of a residence. We do not believe our two audit approach is inconsistent with this provision. We interpret NECPA's provision to prohibit requiring a utility from making the same inspection twice, not to prohibit separate visits by different auditors to address separate measures.

Paragraph (b)(1) requires the State Plan to specify how soon a utility or fuel supplier must perform an audit after the customer requests it. This time limit must be reasonable, based on such factors as the resources of the utilities and fuel suppliers and the needs of the customers. We considered establishing a limit, such as sixty days, in the Proposed Rule, but decided that there could be legitimate justification for alternative time periods. We believe some time period must be established so that utilities and fuel suppliers can know what size staff to hire and how much promotion to undertake, and so that customers will have a reasonable expectation of prompt service.

Paragraph (b)(2) requires States to prohibit other methods of estimating conservation potential as preconditions for a customer to receive an energy audit under the program. In particular, we require prohibition of what are known as Class "B" audits. A Class "B" audit is one which requires the homeowner to fill out a questionnaire asking for the measurements of the house, rather than involving a visit to the house by a trained auditor. this provision does not prevent States or utilities and fuel suppliers from offering such services in addition to on-site audits or State Regulatory Authorities from allowing different

charges for an audit depending on whether a Class B audit is accomplished first. We believe this provision to be necessary to carry out the law's intent that each customer who wants an on-site audit receives one upon request.

We considered requiring that a customer receive an energy audit of all suggested conservation measures *before* receiving an audit of any renewable resource measure. Conversely, we also considered prohibiting the use of such a precondition for renewable resource audits. The Proposed Rule is silent on this point, and thus allows States to choose whether to establish such a requirement or prohibition. We invite comment on these alternatives.

Paragraph (b)(3) prohibits utilities from discriminating unfairly among its eligible customers in providing energy audits. This provision follows from the NECPA provision (section 213 (b)(2)(A)) which requires States to prohibit unfair discrimination by utilities among its customers under this program. However, the Proposed Rule does leave substantial flexibility to utilities in the conduct of their audits. One example of a distinction which is not unfair is allowing utilities to provide audits to customers in certain neighborhoods at certain times to reduce travel times for auditors.

Paragraph (c)(1) requires the auditor to present certain results of the audit to the customer, and requires that these results be in writing. In addition these results must be presented in person. DOE believes that in-person presentation of the results will be more effective in persuading customers to take action than would mailing the results several days or weeks after the visit. Our investigations indicate that it is possible to complete an audit, including the necessary calculations, in one visit to the home. However, the Proposed Rule would allow the auditor to return for a second visit if the calculations were to be performed away from the home. We recognize that this provision will have a substantial effect on auditing procedures and invite detailed comment on it.

Subparagraph (c)(1)(i) requires the auditor to present a reasonable estimate of the contractor-installed cost of each suggested measure. We considered requiring, in addition, the presentation of do-it-yourself installation costs for several measures, but decided to leave this choice to the State or utilities and fuel suppliers. Subparagraph (ii) requires the auditor to present a reasonable estimate of the savings for each suggested measure. We considered specifying the time-period for such estimates (such as "first-year savings estimate"). Our model audit will contain this time-period. We also considered requiring presentation of simple-payback periods or other similar measures of cost-effectiveness. However, because the value of this information is unclear and open to substantial disagreement, we have left the choice of adding such information to the State or utilities and fuel suppliers. We invite comment on this decision.

Subparagaph (iii) requires a certain disclosure, or its equivalent, concerning the validity of the estimates which the customer receives. DOE believes that such a disclosure is vital to make the customer aware that the estimates are not a guarantee of savings, but that they are reasonably valid given the state of the technology of estimation. We invite comment on the particular wording we have chosen, and on the question of whether we should eliminate the words "or its equivalent" from this subparagraph.

Subparagraph (c)(1)(iv) and paragraph (a)(1) require that an audit include an assessment of which of the energy conserving practices (as defined in the rules) are applicable in the customer's home. We believe that these low-cost or no-cost steps are often the most effective actions a person can take to save energy, and that it is important for the auditor to emphasize this fact.

Subparagraph (v) establishes several additional results which must be presented with respect to renewable resource measures. In general, these additional requirements are necessary because of the substantial variation among the actual products which a customer may eventually purchase. That is, two products which are both called "solar domestic water heating systems" may have very different costs and characteristics from each other and from the model system which the auditor uses. Subparagraph (v) also contains and additional disclosure about this variation which must be given to the customer for any renewable resource audit. We seek comment on whether these additional requirements are necessary and also on whether they provide sufficient information to the customer.

Paragraph (c)(2) requires the State to prohibit utilities and fuel suppliers from providing cost estimates for self-installation of furnace efficiency modifications and load management devices, because of the safety problems of improper installation. These measures should only be installed by persons meeting certain minimum qualifications.

Subsection 456.307(d) contains our proposals for the minimum standards for the calculation procedures for the cost and savings estimates to be provided by the auditors. These estimates must be based on local data for fuel and materials, and on measurements which the auditor makes of the house, rather than on measurements which the customer makes. Some evidence must be given to the customer of the fact that the savings from a combination of suggested measures is likely to be less than the sum of the savings of each measure installed individually.

We considered several alternatives to the provisions contained in the Proposed Rule. At one extreme, we considered establishing a single national auditing procedure which would prescribe the measurements which the auditor must make, the formulas which must be used, and the content of the results. As mentioned above, DOE is developing such a procedure as part of its assistance to States, utilities, and fuel suppliers. We also considered prescribing only the measurements which the auditor must make on-site in making estimates, such as area of the house, amount of ventilation, temperature settings by the occupants, etc. Finally, we considered eliminating any prescription about audit procedures. The Proposed Rule sets a performance standard for audit quality to be met by auditors, and allows States and/or auditors a great deal of flexibility in choosing particular auditing procedures. We are particularly concerned about whether this degree of flexibility is appropriate with respect to renewable resource audits, since so few people have experience with such audits. We seek comment on the alternatives we considered.

Paragraph (d)(2) requires that any audit of a home with an oil furnace include a test of the steady-state efficiency of that furnace. This provision is discussed above in "E. Suggested Measures and Categories of Buildings" under the heading "Replacement Oil Burners."

We recognize that variation is inevitable when two different people perform audits, but paragraph (d)(3) sets a minimum standard of consistency for audit results. Subparagraph (d)(3)(i) requires that if an eligible customer receives audits from two or more covered utilities or participating fuel suppliers, these audits must be based to some extent on the same basic assumptions about fuel prices, prices for suggested measures and climate. Subparagraph (3)(ii) requires the State to establish procedures to assure consistency for all auditing procedures used in the State for making measurements and calculations. We considered requiring that the State establish a single auditing procedure for use by all covered utilities and participating home heating suppliers. We seek comment on whether paragraph (d)(3) establishes an appropriate level of consistency.

One potential source of variation between audits is the type of each measure assumed in the calculations. Selection of type will affect both the cost estimates and the savings estimates provided by the auditor. We have not prescribed the types which must be assumed, but recognize their selection to be a source of variation and possible abuse. In particular, the auditor may be given discretion to choose passive solar devices, which will substantially affect the cost and savings estimates, and the attractiveness of this measure to the customer. We seek comment on the need for our rules to address the selection of types of suggested measures.

Subsection (e) requires auditors to provide certain other information to customers about the other services offered under the State Plan. We considered but rejected requiring the auditor to inform the customer of the benefits of other programs as well, including Federal and State tax credits, and also to provide the customer with information on the self-installation of certain measures. We invite comment on whether such information should be part of the rules.

Paragraph (f)(1) prohibits the auditor from providing any information to the customer about products other than suggested measures, unless the customer specifically requests such information. This provision is similar to that in the Program Announcement section, since we again do not want products other than suggested measures to appear to have any endorsement by the DOE or the State unless they have been evaluated. Though we considered an outright ban on additional information, we believe that many customers will ask questions about products they have heard described as energy-saving. We do not wish to discourage auditors from being familiar with the characteristics of these products. We wish to prevent auditors from promoting products which may be less effective than the suggested measures, under the guise of the national conservation program.

Paragraph (f)(2) prohibits the auditor from recommending any supplier, contractor, or lender if such recommendation would unfairly discriminate among such firms. This paragraph provides, however, that if a utility or fuel supplier sells, installs, or finances suggested measures, the auditor may state this fact to the customer. This paragraph is a compromise between the competing goals of, first, establishing an effective information and promotion program and, second, preserving and possibly promoting competition in the sale of suggested measures. Paragraph (f)(3) is closely related, in that it requires the auditor to disclose any conflict of interest he or she may have before the audit is performed, in order to make the customer aware of any potential bias in the results.

We considered two major alternatives to this approach. The first is to prohibit the auditor from having any interest in the sale of any suggested measure. This would require utilities and fuel suppliers to hire their own auditors or to hire firms which offered only auditing service. (It would also reduce the motivation of the auditor to encourage the customer to purchase suggested measures.) One reason we rejected this alternative is that we do not believe that a substantial number of firms exists which perform audits but do not sell measures. The second alternative is to allow auditors to have an interest in the sale of measures, and allow them to recommend themselves to do the work. This alternative might be the most effective in selling measures to customers, but it would also be highly anticompetitive, since the auditor chosen by the utility or fuel supplier would have a tremendous and unfair advantage over his or her competitors. We seek comment on these alternatives, and on our compromise provision.

Subsection (g) carries out the requirement of NECPA (section 215 (b)(2)(B)) that no utility or home heating supplier inspect any furnace for which it does not provide fuel unless the customer requests such inspection in writing. The Conference Report on the legislation charges the FTC with close monitoring of this provision of the Act.

Subsection (i) requires the States to require that auditors be qualified according to the procedures which are contained in § 456.314 below. DOE believes that the abilities of the auditors are crucial to the success of this program. We have established broad areas of competence in which the auditor must be qualified by the State. In our technical assistance program for States, we propose to develop a recommended curriculum for the training or certification of auditors. We considered establishing such a curriculum as a part of the rules, but this would limit State flexibility substantially. We invite comment on this alternative.

### H. ARRANGING INSTALLATION

Section 215(a) of NECPA requires utilities to include procedures for informing eligible customers of "the availability of arrangements described in Subsection (b)." Subsection (b) requires utilities to "arrange to have the suggested measures installed * * *." No further description of this arranging service is provided.

Section 456.308 of the Proposed Rule contains the requirement to arrange installation of suggested measures. In an effort to encourage flexibility in developing State Plans, this Section provides States the opportunity to develop and describe an arrangement service of their own choosing. Subsection (b) requires, however, that the arrangement service must entail more than the distribution of a list of suppliers and contractors. We have included this requirement for two reasons: First, we do not believe that the mere distribution of lists is a service that will encourage many customers to purchase suggested measures; and second, NECPA clearly addresses "arranging installation" and "distributing lists" separately, to ensure that they are not the same service. The arrangement service is essential to the success of the program for several reasons:

(1) The arranging service provides the minimum eligibility for certain program benefits, as required in § 456.305. Eligible customers participating in the arrangement could be guaranteed the following services:

- Measures installed in compliance with the installation standards
- Materials which contain a 3-year warranty and which meet DOE standards
- Quality control in the form of random inspections (or with respect to certain measures, mandatory post-inspections)
- Assistance in resolving a complaint against a contractor
- Opportunity to pay for the installation on the utility bill

Without a clear definition of the arranging service, it is difficult to determine who shall receive these services and to insure that they receive them.

(2) The arranging service provides a means for complying with the reporting requirements. It is an accurate and effective means to determine how many installations and what types of installations occurred "under the program."

(3) The arranging service provides a means to evaluate the performance of listed contractors. Without a well-defined arranging service, it is difficult to determine which contractors are installing measures "under the program" and, therefore, complying with the installation standards.

We recognize that defining an arrangement service which is both useful and not anticompetitive is a difficult task. NECPA contains several constraints on utility efforts to arrange installation of measures. We considered several alternative prescriptions for the arrangement service, but have decided to leave the selection to the State. We seek comment on alternative arrangement services which State Plans could require.

One concept of the arranging service which we considered is the following:

The covered utility would provide all recipients of the energy audit, as well as all eligible customers who request it, with the State-developed list of contractors. The list contains the name, address, and measures installed by each contractor, but contains no telephone numbers except that of the utility or fuel supplier. The customer who wishes to receive bids for installation of measures would then call the utility or fuel supplier, thereby triggering the arranging service. The eligible customer may then select the names of contractors off the list from whom he would like to receive bids, or may then request the utility or fuel supplier to select randomly the names of contractors. In both cases, the utility or fuel supplier would arrange initial contact between contractors and customers.

Whever a contractor is contacted by the utility or fuel supplier, he or she is required to submit copies of bids and contracts which he or she provided to the customer. The utility or fuel supplier will file these for use in meeting recordkeeping requirements, conducting random inspections, and meeting other program obligations. The service provided to the customer would principally be the assurance of quality control and access to grievance procedures.

Earlier versions of the legislation allowed all utilities to install suggested measures. Utility activities related to installation have been, for the most part, reduced in NECPA to include only arranging (see Subpart E of the Proposed Rule). Congress was concerned that utilities might, through the operation of the RCS Program, adversely affect competition in the installation of conservation measures. We are similarly concerned about installation by home heating suppliers. This could also occur if utilities and fuel suppliers favor specific contractors on a non-competitive basis, or if States develop relatively subjective listing criteria. Such Criteria might include a specific number of years in business or include only companies of a specific size (see below: "L. Lists").

Restricting participation in the RCS Program by such criteria would be unacceptable. It is to protect against such an approach that § 456.308(d) of the Proposed Rule requires States to prohibit in the State Plans utilities and fuel suppliers from unfairly discriminating among contrators in recommending, selecting, or providing information about their services.

Comments are specifically invited on two questions raised by this section on the Proposed Rule. First, what approaches to the arranging function should we approve as part of State Plans? Second, does the Proposed Rule provide adequate safeguards for competition? With respect to both questions, we solicit comments on whether utilities and fuel suppliers could "arrange" installation by having a limited number of contractors on call, such contractors having been selected in a competitive and fair manner. In this regard, what form of selection would be competitive and not *unfairly* discriminatory. We note that several successful existing utility programs arrange installation through a limited number of contractors.

### I. ARRANGING FINANCING

Section 215(a) of NECPA requires utilities to include procedures for informing eligible customers of "the availability of arrangements described in Subsection (b)." Subsection (b) requires utilities to "arrange to finance the purchase and installation costs of suggested measures."

Section 456.309 contains the requirement to arrange financing of suggested measures. We have provided the State maximum flexibility in developing an arrangement service which best suits the needs of the people within that State. As with the arrangement service for installation, DOE feels that well-defined finance arranging is important to the success of the over-all program. Section 456.309(b) also requires that "arranging financing" entail more than the distribution of lists of lenders.

As with arrangements for installation, we recognize that defining an arrangement service for financing is difficult. We considered several alternatives, and seek comment on which arrangement services should be acceptable.

Two examples are:

The utility or fuel supplier could distribute the State-developed list of banks and lending institutions and provide loan application forms to customers from institutions selected by the customer. In addition, the State may consider requiring utilities and fuel suppliers to provide annual percentage rates of the lending institutions on the list to customers who request it.

Or, the State may want to consider an arranging service in which the utility or fuel supplier would provide a standard credit form which, when filled out by the customer, is distributed to lending institutions selected by the customer or randomly selected by the utility or fuel supplier. The customer could then select the one which offers the best terms. Handling fees, if required, could be expensed or charged directly to the customer as determined by the covered utility, the State Regulatory Authority, or the fuel supplier.

We do not believe it was the intent of Congress to subject utilities or fuel suppliers to provisions in the Truth in Lending Act (15 U.S.C. 1601, *et seq.*) if they are not already subject. Neither do we believe that Congress intended to establish a Federal requirement that utilities and fuel suppliers be a lender of last resort. Utilities and fuel suppliers should not be expected to accept a financial risk greater than that accepted by other lending institutions, unless the State Plan so provides.

When describing the arrangement service the State may wish to consider the following questions:

- Must the utility or fuel supplier provide billing services if an eligible customer does not participate in the arranging service?
- If the customer selects a lender other than one arranged through the utility or fuel supplier, is he or she still considered "under the program" and therefore, eligible to receive program benefits? (See Section 456.305(c) of the Proposed Rule).

The same interest in promoting fair competition among contractors also applies to lending institutions.

We seek comments regarding approaches for arranging financing which we could either include in the Proposed Rule or approve as part of a State Plan.

### J. ACCOUNTING AND PAYMENT OF COSTS

Section 215(c) of NECPA requires each utility RCS Program to include procedures to assure that all amounts expended or received by a utility which are attributable to the RCS Program (Including any penalties paid by such utility under Section 219(d)) are accounted for on the books and records of the utility separately from amounts attributable to all other activities of the utility. Section 456.310 of these rules requires utilities subject to the jurisdiction of the Federal Energy Regulatory Commission (FERC) and rural electric cooperatives to utilize certain prescribed accounts established by FERC and Rural Electrification Administration (REA). Nonregulated utilities are required to use accounts within their accounting system with similar attributes.

Subsection (a) requires regulated utilities and rural electric cooperatives to use "Customer Assistance Expenses," for amounts expended and Account 456, "Other Electric Revenue" (for electric utilities) and Account 495, "Other Gas Revenue" (for gas utilities) for billed income. Other nonregulated utilities are required to use equivalent accounts. The requirement to use the specified accounts and procedures is to assure uniform accounting treatment of activities under the program. Uniform accounting treatment is required in order for State agencies and the DOE to analyze accurately RCS Program costs and the allocation of these costs to ratepayers.

The specified accounts are based on the existing FERC and REA Uniform System of Accounts and may be changed as FERC and REA revise their uniform system of accounts by rulemaking.

Subsection (b) prescribes the three allowable methods of payment for program costs. All costs incurred must either be charged to the eligible cus-

tomer for whom an activity is performed or be treated as a current expense of providing utility service and charged to all ratepayers of the utility in the same manner as current operating expenses of providing such utility service, unless the cost is incurred by the utility to perform services for the State under the program, in which case the State may reimburse the utility for those costs. The costs associated with the Program Announcement and all public education and program promotion related to the RCS Program are required to be treated as a current expense of providing utility service. The costs of labor and materials incurred by a utility for the purchase and installation of any energy conservation measure are required to be charged to the residential customer for whom the activity was performed. The treatment of the costs of general administration, and of the project manager requirements (including energy audits, lists, and arrangements for installation and financing) shall be decided by the State Regulatory Authority for regulated utilities and by each nonregulated utility for itself in accordance with one of the two generally prescribed methods of payment. Other costs, including interest on a loan made by a utility, are to be charged to the eligible customer for whom the activity is performed unless the appropriate regulatory authority finds, after public notice and opportunity for public hearing, that treatment of the cost as an operating expense will result in lower rates to ratepayers by reason of reduced demand for energy than would have occurred had the cost not been treated as an operating expense.

It is expected that energy audits will be the most costly program service the payment of which is left to the discretion of the Regulatory Authority or nonregulated utility. Subsection 310(c) makes it clear that Regulatory Authorities or nonregulated utilities may establish a policy of allowing only one free or subsidized audit to each residential customer. This policy might reduce program costs in those areas served by more than one covered utility.

### K. BILLING, REPAYMENT, AND TERMINATION OF SERVICE

Section 215(f) of NECPA addresses the requirements pertaining to loans made by utilities, fuel suppliers or other persons under the RCS Program. These requirements have been incorporated in § 456.311(b) of this Proposed Rule. this subsection provides for the repayment of loans made directly by a utility or fuel supplier to a customer under the Program as a part of a periodic utility or fuel bill, at the option of the customer. It also provides for customer repayment of the principal and interest of the loan amount over a period of not less than three years, unless the customer chooses a shorter repayment period. Subsection (b) also provides for the repayment through the utility or fuel bill of loans made by other lenders under the program, providing that such an arrangement is acceptable to such lender. Section 456.311(a) requires that any costs of carrying out any activity under the program which is directly charged to the customer for whom the activity is performed be stated separately on the bill from the utility or fuel service charges. This provision is required by Section 215(c)(2)(B) of NECPA.

Section 215(e) of NECPA prohibits covered utilities from terminating utility service due to a customer's default with respect to any payment due for measures installed under the program. Section 456.311(c) of the Proposed Rule expands this provision to prohibit *restriction* of service due to default, since this seems consistent with the intent of the legislation.

In line with the intent of Section 215(e) of NECPA, § 456.311(a)(2) requires that, when costs associated with the program are included in a customer's periodic utility or fuel bill, payments be credited first to the utility or fuel service costs with any excess credited to other costs, unless the customer requests an alternative distribution of payments. This prevents a utility or fuel supplier from crediting a partial payment first to an outstanding loan appearing on the bill, and restricting or terminating a customer's utility or fuel service due to his failure to pay utility or fuel service costs.

With respect to loans made either by a utility, fuel supplier, or by another lender to a customer under the program and appearing on a periodic utility or fuel bill, Section 215(f)(2) of NECPA makes clear that a lender may require lump-sum payment of outstanding loan due in the event of a default in payment by the customer. The same subparagraph also requires that no penalty be imposed by the lender in the event of prepayment of a loan by a customer. These provisions are included in § 456.311(b)(4) of this Proposed Rule.

The Fair Credit Billing Act (FCBA), and the regulations issued pursuant to the FCBA—known as Regulation Z, establish a mandatory dispute resolution procedure for alleged billing errors appearing on periodic statements sent to customers in connection with "open end" customer credit accounts. In enacting the FCBA, Congress recognized that there will inevitably be instances of billing errors when periodic billing statements are sent in large volume and therefore established mechanisms for facilitating dispute settlement. While many credit transactions under this program are likely to be closed end in nature, the Proposed Rule will permit periodic billing through the utility or fuel supplier, but because it is closed end, such billing is not covered by the provisions of the FCBA. Periodic billing by the utility and fuel supplier is no less subject to billing errors than the open end transactions presently covered. Therefore, subsection (b)(3) imposes requirements which parallel those of Regulation Z on bills sent by the utility and fuel supplier for loans or purchases of suggested measures. We seek comment on this requirement and on whether a disclosure of these procedural guarantees ought to be included on each bill sent to a customer for repayment of a loan.

### L. LISTS

NECPA contains three major provisions with respect to lists of suppliers, contractors, and lenders:

(1) DOE must promulgate standards for procedures to assure that firms are included on the lists in a fair, open, and nondiscriminatory manner. The rules must include procedures for delisting such firms in appropriate circumstances as well as procedures for redress of any complaints they may have about the lists.

(2) State Plans must contain adequate procedures to allow such firms to be included on such lists.

(3) Each utility or home heating supplier program must include procedures to provide these lists to each eligible customer.

The Conference Report on NECPA expands on these requirements:

> "In connection with the applicable procedures in the State Plan, the Governor shall identify in the plan, the person or agnecy responsible for developing lists of approved suppliers, lenders, and installers, and for implementing delisting procedures. The person or agency so designated shall not be a regulated utility."

Because of the division of responsibility for developing and distributing the lists, we have created the term "Master Record" to describe the files of qualified firms kept by the listing agency designated by the State as distinguished from the lists which must be distributed by the utilities and fuel suppliers. Subsection (a) requires the State Plan to provide for the development of the Master Record, and establishes the procedures for its development. Paragraphs (a) (2) through (4) require the listing agency to include all qualified firms, and only such firms, in the Master Record.

Paragraph (6) requires the State Plan to contain procedures for removing firms from the Master Record, and to provide certain minimum procedur-

al guarantees for complaints if a firm believes it has been unfairly treated. The specific criteria for removing contractors, suppliers, and lenders from the lists are left to the State. DOE considered prescribing the criteria for removal of firms, such as requiring removal after repeated violations of installation standards, or after a specified number of violations. Though the Proposed Rule allows States to establish these criteria, we believe that firms should be delisted for repeated violations of the listing requirements, even if they correct these violations. We request comment on these alternatives.

Paragraph (6) is meant to assure that utilities and home heating suppliers are notified monthly of any additions or deletions to the Master Record. Along with the requirement of Paragraph (c)(5) that utilities and fuel suppliers use this information in providing arrangement services, this provision assures consumers some protection against contractors who have been delisted. This provision does not, however, require that the distributed lists be changed every month. We seek comment on alternatives to the one-month notification period.

Subsection (b) contains the criteria which each of the three groups of listed firms must agree to meet in order to be included on the lists. In general each of these criteria is meant to assure consumers that listed firms will meet certain minimum standards of performance for work or services performed. However, we wish to avoid creating so many requirements that few firms seek to be listed, or that their prices for services performed under the program become too high. We seek comment on the balance we have proposed in this subsection between these conflicting goals.

The State must determine under what circumstance jobs and services performed by listed firms must meet the specified criteria and which need not. For example, Subparagraph (b)(1)(i) requires installation contractors to agree to meet the material and installation standards in every job performed under the program. At a minimum (as required by section 305) this must include all installations arranged by the utility or home heating supplier. But a State could require that all listed contractors meet the material and installation standards for every job which they perform for a customer who is sent the lists by a covered utility or participating home heating supplier. We considered prescribing an even broader application of the standards: requiring that all contractors and suppliers who wish to be included on the lists agree to meet the standards in every job they perform, whether "under the program" or not. However, if the program is successful and encompasses virtually all sales of suggested measures in a particular area, this approach to listing would eliminate products from the market which did not meet our standards. To the extent that our standards assure a level of quality above that preferred by many customers, this would unduly reduce consumer choice and competition. In addition, the Conference Report makes it clear that the Congress did not intend for this program to be the vehicle for establishment or enforcement of national standards for various conservation products. At present, only the Consumer Product Safety Commission (CPSC) has any such national authority regarding energy conservation measures. CPSC has specific authority regarding the safety of cellulosic insulation.

Subparagraphs (iii) to (vi) set additional requirements for installers. These requirements are designed to protect consumers. Subparagraph (vii) requires that a copy of the contract for any installation performed under the program be sent to the utility or home heating supplier. These contracts will serve as a record to use in evaluating the program, and will serve as the pool from which random inspections will be performed. Subparagraph (vii) has a serious drawback when a covered utility or participating home heating supplier both installs and arranges installation of suggested measures. Since this provision requires that the utility or home heating supplier receive copies of the contracts performed by their competitors, including price and other job specifications, these utilities or suppliers would then have a substantial competitive advantage. We are considering additions to our rules to eliminate this problem, and seek comment on it.

Paragraph (b)(2) establishes the minimum criteria for inclusion of suppliers. Again, we have decided not to prohibit suppliers on the lists from selling non-standard products. Instead, we have decided that they must offer products which meet the standards, but may sell others as well. However, the suppliers on the list must display prominently in their stores a statement of which products meet the DOE standards. We have not included any further requirements for suppliers, because of the difficulty of determining when a customer purchases a measure from a supplier "under the program." We seek comment on whether these listing criteria are reasonable or need to be more or less stringent.

Because of the potential safety hazards associated with installation of vent dampers and electronic ignition devices, we considered requiring that all listed suppliers agree not to sell such products for installation by an untrained person. We have included no such requirement, but seek comment on it.

Paragraph (b)(3) establishes the minimum criteria for lenders who wish to be listed. Each criteria is designed to provide certain procedural protections or disclosures to consumers who seek or obtain loans under the program. As with installation of measures, the State has substantial flexibility in deciding which loans must be covered by these criteria and which do not. At a minimum, a lender must meet these criteria for any loan arranged by a covered utility or participating home heating supplier.

With respect to Subparagraph (3)(ii), DOE considered prohibiting lenders from requiring or taking a security interest in a home for any loan under the program of less than $2000. We decided that this might unnecessarily restrict access to loans by some customers, and instead we propose a disclosure. We seek comment on the alternative approach.

Paragraph (b)(4) allows the State to use additional criteria for suppliers, contractors, and lenders only if the Secretary determines that such criteria are fair and nondiscriminatory. We considered allowing or requiring certain qualifications such as bonding or licensing to be criteria. In general, we found that such qualifications are not necessarily a good indication of the quality of work which a firm performs. We seek comments on what additional qualifications should be allowed in State Plans or required in our rule, and what effect such qualifications would have on competition or on new or small firms.

Subsection (c) establishes the actual printed content of the lists and the procedures for printing and distributing the lists. NECPA states that the covered utility or participating home heating supplier must "provide" the lists to every eligible customer. The Conference Report clarifies that the intent of this provision is not that the covered utility or participating home heating supplier mail the lists to every customer, but the lists should be provided to customers in a timely and convenient manner. This subsection requires that the lists be provided to every customer who requests them. Section 456.307 also requires that the lists be given to every person who has an audit performed.

Paragraph (c)(1) requires certain basic information about each firm to be included on the lists. Paragraph (2) requires certain disclosures to appear on the lists. We believe that there is substantial potential for consumers to be mislead about the meaning of the lists unless these disclosures are prominently displayed. This will also repeat and emphasize information pro-

vided in the Program Announcement and by the auditor explaining under what circumstances the various standards and criteria apply. We considered but rejected including in the Proposed Rule a requirement that the lists of lenders include advice to customers about how to shop for credit. We seek comment on whether such advice ought to be required.

Paragraph (c)(4) requires that the Secretary approve any additional requirements or allowances of the State Plan with respect to information on the lists. We considered numerous additional types of information which could be included on these lists and rejected each of them. Examples of such rejected information are: (1) Prices or interest rates which a supplier or lender charges for products or loans; (2) the number of years a particular firm has been in business; and (3) the level of bonding or insurance carried by the firm. This information was believed to be anticompetitive in nature, or irrelevant to the quality of work which a firm might perform. We also considered the approach of requiring, or at least allowing, lists of lenders to include a standard measure of interest rates, such as Annual Percentage Rates (APRs). Consumers are generally not used to comparative shopping for loans, and including APR's on the lists could help. However, we decided to prohibit them in our Proposed Rule, unless specifically approved by the Secretary. We seek comments on these prohibitions and on any alternatives which would allow States more flexibility in preparing lists.

Paragraph (c)(6) requires State Plans to provide that the lists are reprinted every six months to assure that the lists which customers receive are no less current than six months. This paragraph is separate from the requirements of Paragraphs (c)(5) and (a)(6) which together require that any lists which a utility or home heating supplier uses in providing the arrangement services be no less current than one month. We seek comment on the effect of these updating requirements.

### M. POST-INSTALLATION INSPECTION

Section 212 of NECPA directs the Secretary to promulgate standards which he determines necessary for the installation of any suggested measures as well as establish other requirements which he determines to be necessary to carry out this Part. DOE has proposed the following procedures to ensure that the standards promulgated under this Part for the safe and effective installation of measures are fully implemented.

*Mandatory Inspections of all Vent Dampers, Electric Ignition Systems, and Wind Energy Systems.* DOE has determined that the quality of the installation of these measures is critical to the safety of the occupants of buildings so equipped. DOE, therefore, requires each installation of these measures to be inspected within one week of installation. DOE determined that a one-week period was sufficient for the logistics involved in the arrangement of inspections while at the same time minimizing the potential hazards which could occur from improper installations. We considered requiring the inspections of vent dampers and iginition devices any time prior to the beginning of the heating season, but rejected this approach since it allowed too great an opportunity for hazardous situations.

DOE has also established criteria to assure that each inspection is carried out effectively and objectively by requiring that the person conducting the inspection:

- Meet the criteria for inspectors of each specific measure as detailed in § 456.314; and
- Have no financial interest in the contractor who installed the measure.

An exception to the second criteria is made for persons inspecting installations conducted by covered utilities or participating home heating suppliers. This exception was made because we believe that utilities and suppliers are permanent members of a community whose interest in safe installation may be relied upon.

DOE requires inspectors to test the compliance of installations with the applicable installation standards promulgated under this part. Inspection results are required to be reported to the customer and installer as soon as possible to ensure that any corrective actions which are required are executed without delay. The inspector is also required to report the results of the inspection to the Listing Agency within a reasonable period of time to form a record for any possible delisting procedures.

*Random Inspections.* DOE has determined that the qualifying procedures for installers of suggested measures alone are insufficient to guarantee that installations are properly carried out under this program. Therefore, DOE has proposed the following schedule of random inspections of installations:

- Forty percent of the first ten insulation installations under the program by each insulation contractor; and
- Twenty percent of the installations of each suggested measure done under the program, excluding those measures covered under the mandatory inspection requirements but including installations of insulation materials.

DOE has required specific inspections of insulation installations because improper installations are not easily detected by the homeowner. Improper installations could result in both short-term and long-term problems relating to fire or structural damage, as well as reduced effectiveness of the insulation material. Therefore, DOE requires that a random sample of each contractor's work be evaluated to ensure that no contractor is installing materials in a manner which may lead to the creation of hazards in the future. This inspection will also ensure that measures are installed effectively. DOE does not envision its inspection program of insulation installations as a punitive measure, but rather as a tool for teaching installers the proper method for the safe and effective application of insulation materials.

We also considered two other alternative levels of random inspections: (1) One hundred percent of all installations for at least the first year of the program; and (2) no specified inspection requirements. This latter alternative was unacceptable to us because several utilities and the TVA have found a large number of faulty installations by contractors under their existing programs. However, 100 percent inspections seemed unnecessary to ensure compliance with the installation standards, as long as the inspections are performed in a truly random fashion. We seek comment on our decisions in this area.

Paragraph (b)(3) requires that the random inspections determine compliance with the installation standards for energy conservation and renewable resource measures, but not with material standards. We believe that in most cases the only way an inspector could verify compliance with the material standards for any measure is by removing a sample of the product or material from the house and sending it to a laboratory for testing. This is particularly true for insulation, and less so for other measures. Such a testing procedure would be very expensive. However, without it, our proposed rules contain no provisions to ensure compliance with the material standards, except the certification by the contractor or supplier that the standards are met. We considered requiring third-party certification of compliance of products with the material standards. Such a certification requirement might be very costly to manufacturers. It would be more appropriate for a nationally-enforced standard than for our standards, which apply only ot our program. We seek comment on how compliance with these standards under this program might be enforced, and the need for an enforcement mechanism for material standards.

DOE has determined that, initially, a random inspection program of all measures installed is necessary to

ensure that installers perform in accordance with the installation standards of the program. DOE has given each State the option to reduce this requirement after a period of time provided that the State can demonstrate to the Secretary that the twenty percent random inspection is unnecessary to ensure safe and effective installation of suggested measures under the program. We considered removing this aspect of State flexibility. We seek comment on whether random inspections should be required for the duration of the program.

Paragraph (b)(2) contains criteria for inspectors performing the random inspections, who must:

- Meet the applicable criteria of Section 456.314, and
- Have no financial interest in the contractor who installed the measures.

Where the contractor is the covered utility or participating home heating supplier, the State is required to provide an inspector who has no financial interest in such contractor.

The inspectors must determine that the installation being inspected complies with the applicable Installation Standards of the program and must report the results of the inspection within a reasonable period of time to the customer, the installer, and the Listing Agency to assure that, where necessary, corrective actions are taken.

We also require the State Plan to identify the person or agency responsible for administering the procedures for post-installation inspections and permit the Listing Agency to carry out this function.

We also considered requiring that utilities and fuel suppliers offer a post-installation inspection of suggested measures to any customer who requests one. Though there is no specific requirement for such a service in NECPA, we believe that many customers would be willing to pay for such inspections to ensure that they have received a proper installation. This service could also be considered part of the arranging service for those customers. We seek comment on whether we should require such a service to be included in each State Plan.

### N. QUALIFICATION PROCEDURES

We have concluded that to a large extent, the success of the RCS Program depends on the interaction between the eligible customer and the auditor. We have, therefore, established minimum areas of qualification necessary for an auditor to perform his or her function effectively.

The potential safety hazards which may result from the improper installation of three devices is serious enough to warrant special consideration. These devices are vent dampers, electronic ignition devices, and wind energy systems. Accordingly, Section 313(a) requires that each installation of such measures be inspected. Sections 314 (c), (d), (e), and (f) require the persons doing both the initial installation and the post-installation inspection be specially qualified to perform their functions. DOE is currently developing the standards necessary for the installers and inspectors of each of these measures.

We have also concluded that the persons carrying out random inspections must, at a minimum, be qualified on the elements of the installation standards proposed herein and be able to judge conformance with the applicable standard. Subsection (g) contains the minimum qualification elements for these quality examiners.

Subsection (h) addresses the method for qualifying individuals to perform the above functions. This method has not been dictated by DOE but rather has been left largely to the discretion of the States. While the Proposed Rule provides alternatives, such as training, testing, or a combination thereof, which may be used to qualify individuals, the Proposed Rule also allows States to use any other method of qualifying the individual which assures that the individual is qualified to perform his function. Any such method must be included in the State Plan and will be subject to DOE review for sufficiency. Subsection (i) requires the State Plan to describe the procedures for qualifying each of the groups of individuals as well as give assurance that all persons are given a reasonabale opportunity to participate in these procedures. DOE has established the date of first implementation as no later than 90 days following approval of the State Plan, to assure that qualified individuals are available when the RCS Programs are initiated.

### O. CONCILIATION AND REDRESS

Section 213 (a)(5) of NECPA requires that mechanisms be provided for resolving complaints by customers against persons who sell or install suggested measures under the RCS Program. Section 213(c) of NECPA requires that a mechanism also be provided in every State Plan to assure that any person alleging injury under any provision of the State Plan is entitled to redress. Section 213(b)(2) (F) of NECPA requires that contractors, suppliers, or lenders who allege violation of the State standards regarding fair preparation of the lists be afforded redress under the State Plan.

To meet these requirements, DOE has in the Proposed Rule created a three-tier process: A conciliation conference for customers; an informal redress procedure which results in decisions enforceable under State law and which is available to all involved in the program; and the availability of State courts for recovery of damages resulting from activities under a State Plan.

The requirements for the customer complaint resolution procedure (called "conciliation conference" in the Proposed Rule) are described in § 456.315(a) of the Proposed Rule. These requirements are intended to insure that the process is informal, simple, and accessible to customers, to reflect the Congressional directive in the legislative history that the State procedure for resolving customer complaints be fair and expeditious without necessarily requiring formal hearing procedures.

The procedure proposed in the rules would encourage conciliation rather than result in a decision. The rules call for the conciliation conference to be at a place convenient to the customer, to be presided over by an impartial conciliator without a financial interest in the party or the outcome, and for participation in the process to be free of cost to the eligible customer. These requirements are believed to be important for the encouragement of consumer participation in this procedure.

In order for the conciliation conference to be meaningful, two additional issues are addressed in other sections of the rule. Section 456.312(b) of the rule requires that contractors, suppliers, and lenders agree, as a condition for being included on the lists, to participate in this procedure in good faith. In addition, §§ 456.306(a) and 307(e) require that information regarding the availability of this procedure be included in the Program Announcement and that its existence and method of access be disclosed at the time of the audit.

If a customer is dissatisfied with the informal conciliation process, the customer may bring a complaint under the redress procedure contained in § 456.315(b). This procedure is also available to any person alleging injury arising under the program. It is intended that this section also cover contractors, suppliers, and lenders who allege injury related to the preparation of or removal from the lists.

The Conference Report clearly states that existing State procedures may be adequate to meet the requirements for redress under this program. Therefore, subsection (b) is drafted so as to set minimum requirements for a State procedure which allow appropriate existing mechanisms to be utilized. For example, it is intended that a State which has an existing arbitration procedure or small claims court system, which fulfills the minimum requirements of this section, could choose to use such system to meet its obligation to provide for redress. We

seek comment on whether subsection (b) would exclude the use of existing State systems which might be adequate.

Subsection (b) provides that the redress procedure meet five minimum criteria: It must be accessible, fair, low-cost, informal, and expeditious. The proceeding must result in a written decision by the deciding official which includes a short statement of the reasons for the decision. This decision must be made available to the State or State agency responsible for monitoring the lists as an additional mechanism for monitoring compliance by contractors, suppliers, and lenders with their obligations under the program. Subparagraph (b)(1)(iv) requires that the cost of the redress procedure be kept at minimum. We believe that States might allow this cost to be different for different classes of persons, such as contractors, consumers, or utilities.

Subsection (c) requires that a right of action in State courts must be available for recovery of damages resulting from activities under the State plan. Where small claims courts satisfy the requirements of Subsection (b), there would be no separate requirement for Subsection (c). It should be noted that to provide such a right of action may require State legislative action. For instance, it is intended that where failure to install materials according to DOE's standards proximately causes injury, those standards would set the legal requirements with respect to negligence and not "generally accepted" installation standards.

### F. COORDINATION

Section 213(a)(6) of NECPA requires a State Plan to assure coordination of the RCS Program with other State and Federal energy conservation programs. Section 456.316(a) of the Proposed Rule repeats this requirement. Several of the existing Federal and State conservation programs are very similar to the RCS Program. We strongly encourage States to consider methods of coordinating their programs to enhance each of them. For example, utilities could cooperate with local agencies implementing the DOE Low-Income Weatherization Grant Program by distributing information to their customers about eligibility for Weatherization Grants.

Many States may consider methods of cooperation between utilities and home heating suppliers in implementing RCS Programs. For example § 456.307(d) requires certain similarities in the auditing procedures performed by utilities and oil dealers with overlapping service territories. The State Plan may specifically require or allow sharing of information to ensure similarity. Whenever such coordination is permitted, § 456.316(b) requires the State Plan to assure that no collusion on prices or interest rates will occur.

Subsection (c) requires that, if the Lead Agency is not the State Regulatory Authority, then the State Plan must describe how implementation of the State Plan will be coordinated between these two State agencies. We consider such coordination essential to ensure adequate implementation of State Plan.

### G. HOME HEATING SUPPLIERS

NECPA provides for the inclusion of a home heating supplier program in the State Plan at the discretion of the Governor and for voluntary participation in this program by individual suppliers. DOE believes that broad participation of home heating suppliers is essential to the success of the program and encourages their participation. In addition, the Congress has expressed concern about the potential anti-competitive effects of allowing or encouraging gas and electric utilities to inspect oil furnaces. NECPA therefore includes procedures to reduce these effects.

DOE believes that home heating customers must be offered the same services as all other heating customers. Though NECPA distinguishes between the requirements for utility programs and those for home heating suppliers programs (see Sections 215 and 217 of NECPA), we have decided to make customer service requirements in the Proposed Rule identical for both types of fuel suppliers. NECPA also provides flexibility to the Governor to reduce certain of the requirements for home heating supliers because of their limited resources as compared to utilities. We expect Governors to use this flexibility to increase the rate of participation of home heating suppliers, without significantly reducing the level of services and benefits available to eligible customers. To the extent that a home heating customer must look to both his or her heating supplier and to his or her utility to receive complete RCS Program services and benefits, the effectiveness of the program will be reduced and costs increased.

Section 456.317(c) requires the State Plan to include the procedures by which the Governor or the Lead Agency will waive requirements of the Plan for individual home heating suppliers. However, subsection (c) also lists those Plan requirements, discussed below, which we propose to prohibit the Governor from waiving for any home heating supplier who chooses to participate. In general, these are procedural requirements for those activities which the home heating supplier performs.

Paragraph (c)(1) requires the State Plan to contain compliance and enforcement procedures for participating home heating suppliers. We expect that the State penalties for utilities will be different from those for home heating suppliers. We recommend that the only penalty for failure by a home heating supplier to peform a required function be removal from the program.

Paragraph (c)(2) says that the benefits described by § 456.305, such as complaint resolution procedures and coverage of material and installation standards, must apply equally to customers of utilities and to those of home heating suppliers. For example, if a State decides that any customer who has an energy audit performed by a covered utility is then eligible for the complaint resolution procedures for a subsequent installation, whether or not that installation is "arranged," then any customer for whom a home heating supplier performs an energy audit must also be eligible for such procedures. Note that this does not mean that all home heating suppliers must provide the same audits as all utilities.

Paragraph (c)(3) says that if a home heating supplier provides a Program Announcement to its eligible customers, then the estimates of energy cost savings contained in that Announcement must meet the requirements of § 456.306(c) regarding calculation procedures.

Paragraph (c)(4) says that if a home heating supplier provides an energy audit of any suggested measure to its eligible customers, then the auditing methods must meet the requirements of § 456.307(d)(3).

Paragraph (c)(5) says that, with respect to those activities required by the State of a home heating supplier, such supplier must perform those activities in conformance with certain procedures which prohibit anticompetitive activities or unfair discrimination. For example, if the home heating supplier performs energy audits and also sells measures, then the auditor must disclose this interest in the sale of measures.

Paragraph (c)(6) sets those minimum reporting and recordkeeping requirements which we believe essential for any participating home heating supplier, regardless of size. We seek comment on whether these requirements will unduly restrict participation by home heating suppliers.

In developing these rules for home heating suppliers, we have examined most carefully the capabilities of suppliers of #2 heating oil. NECPA allows Governors to include suppliers of propane, butane, and kerosene, and perhaps other fuels. We seek comment

about the suitability of our proposed rules for such suppliers.

Nothing in NECPA or in the Proposed Rule prohibits any home heating supplier from selling, installing, or financing any suggested measure. NECPA does prohibit such activities by utilities, except for certain situations. In those certain situations, NECPA treats utilities and home heating suppliers equally. If a utility does supply, install, or finance measures, NECPA requires certain guarantees of competition to be in the State Plans. Section 214(b) of NECPA also requires these same guarantees to apply to home heating suppliers who sell, install, or finance suggested measures. Both utilities and home heating suppliers who install and finance measures are in a special position with regards to their competitors. That is, they might gain an unfair advantage over their competing installers and lenders as a result of this Government sanctioned program. Therefore, the Proposed Rule treats such utilities and home heating suppliers equally in protecting competition (see §§ 456.306, 307, 308, and 309). We seek comment on the fairness and the effect of these provisions.

#### K. REPORTING AND RECORDKEEPING

NECPA does not establish any reporting requirements for States, but instead gives the Secretary general authority to make such a requirement. The purposes of this section are to collect data for measuring overall program activity and to retain records for more thorough evaluation later. DOE has developed a preliminary evaluation plan for this program, and is considering many alternative ways of evaluating the program.

We considered requiring each State, as part of its reporting requirements, to analyze certain results and perform its own evaluation. We encourage States, as part of their planning process, to establish their own goals for the program and to develop evaluation plans tailored to their own State Plans. In particular, we seek comment on whether we ought to require States to estimate annually the energy savings which have resulted from their programs. Such an estimate could either be based on actual measurements of changes in fuel consumption, or, with less certainty, based on estimates of savings from the energy audits.

Subsection (a) contains the contents of the annual report which the States are required to submit, beginning July 1, 1981.

Paragraphs (1) through (4) require lists of the utilities and home heating suppliers participating in the program, and of those utilities supplying, installing, or financing suggested measures as allowed by Subpart E. Paragraphs (5) through (12) list the program activities which must be tabulated and reported annually. We have included virtually every major program activity in this tabulation, and seek comment on the difficulty of collecting this information. Paragraph (13) requires a report of whether any proposed legislation or regulations, which are required by §§ 456.303 and 456.315, has been enacted.

Subsection (b) requires certain records to be kept. The purpose of these requirements is to assure that an accurate evaluation can be performed in the future. For example, we will want to know what factors have contributed to the success or failure of the auditing programs run by various States, utilities and fuel suppliers. We will want to learn the response of people who have had audits performed, and thus we require the States to assure that the names of these people are retrievable. Subsection (b) does not necessarily require that lists of names be retained, only that the names are retrievable from whatever records are kept.

Paragraph (b)(6) requires that utility and fuel bills be retained for a period of two years. In order to measure the effect of conservation improvements on energy consumption, utility and fuel bills must be available for the year before and the year after the improvement. We seek comment on whether these records are retained by most utilities and fuel suppliers already, or whether this would be a substantial new recordkeeping requirement.

Paragraph (7) requires that the States maintain a record of the individuals who have met the qualification criteria and update such record within a reasonable time following each implementation of the procedures. DOE requires that a separate record be maintained for installers and inspectors of vent dampers, electronic ignition devices, and wind systems. This determination was made to assure that an individual who is properly qualified to install/inspect these particular measures appears only on the record for that measure rather than on a composite record.

In addition to the reporting requirements established by the States and the Department, participants in the RCS Program should be aware that the Federal Trade Commission is required by Section 225 of NECPA to study the implementation of the RCS Program and to submit a report on the program to Congress and to the President by January 1, 1982. Some of the information that is collected by the Department of Energy will be made available to the staff of the Commission. In addition, the staff of the Commission may contact participants in the RCS Program directly during the preparation of the Commission's report.

#### V. SUBPART D—NONREGULATED UTILITY PLANS

Sections 212(c) and 214(a) of NECPA contain essentially the same requirements for Nonregulated Utility Plans as are contained in NECPA for State Plans. Accordingly, Subpart D of these rules, dealing with Nonregulated Utility Plans, contains parallel provisions to Subpart B, dealing with the procedure for submission and approval of plans, and incorporates by reference Subpart C, dealing with the content of plans. Specific exceptions from or amendments to Subpart C provisions are provided in Subpart D with respect to provisions in Subpart C which are not appropriate for Nonregulated Utility Plans.

In addition, Subpart D specifically provides in § 456.408(h) that upon written agreement with the State a nonregulated utility may adopt certain parts of a State Plan by reference. Those parts are the portion of a State Plan dealing with the calculations of costs and savings in the Program Announcement, the calculation and procedures for energy audits, the preparation of the Master Record (as well as the updating and delisting requirements), the mandatory post-installation inspection of certain measures, the quality control random inspections, the qualifications for auditors, certain installers, and inspectors, and the complaints processing procedures. The purpose of this provision is to lessen the cost and burden for nonregulated utilities in carrying out the RCS program by enabling them to utilize State-developed or State-run services. Where nonregulated utilities incorporate those parts by reference, however, they may be treated much like nonregulated utilities subject to a State Plan. For instance, specific provision is made in § 456.408(h)(3) that if a nonregulated utility uses a State Master Record, the nonregulated utility loses control over who is listed and delisted on the lists which it distributes. Moreover, a State, as a condition of allowing the nonregulated utility to utilize a State-developed or State-run service, may require the nonregulated utility to subject itself to such oversight or controls as may be appropriate with respect to that service.

#### VI. SUBPART E—SUPPLY, INSTALLATION, AND FINANCING BY UTILITIES

Sections 216 of NECPA addresses the supply, installation, and financing of residential energy conservation and renewable resource measures by a covered utility. Section 216(a) of NECPA broadly prohibits such supply, instal-

lation, or financing. This prohibition was responsive to the fear that, if a utility not only audited a home but also supplied, installed, or financed measures, there was a substantial potential for anticompetitive or unfair and deceptive practices. Section 456.502(a) of the Proposed Rule repeats the prohibition of Section 216 of NECPA. Section 456.502(b) makes clear that, notwithstanding the exemptions from this prohibition provided by NECPA, which are described below, where the Secretary finds that such exempted activities have anticompetitive effects, he may impose the prohibition. Violations of the prohibitions of § 456.502 (a) or (b) (Section 216 (a) or (g) of NECPA) are punishable by a civil fine assessed by the Secretary for $25,000 for each day of violation. Again, this merely restates the applicable NECPA provisions (see Sections 215(h) and 219) which also specify the procedure by which such fines may be assessed. Section 456.501 defines "supply," "install," and "finance" for purposes of subpart E. It should be noted that if a utility leases a measure to an eligible customer, it is considered installed by the utility, no matter who does the actual installation.

Notwithstanding the prohibition in Section 216(a) of NECPA, NECPA provides a number of exceptions from this prohibition. The exceptions provided in Section 216 (b) and (c) for loans under $300 and the supply, installation, and financing of certain measures are repeated in § 456.503. The grandfather provision for existing or advertised supply, installation, or financing activities by utilities (Section 216(d) (1) and (2) of NECPA) is repeated in Section 456.504 (a) and (b). Section 456.504 also makes clear that the prohibitions of § 456.502 (Section 216(a) of NECPA) do not become effective until 30 days after the final promulgation of these rules, and they are further delayed by an application to DOE for the requisite determination. These provisions are necessary to insure that prior existing utility supply, installation, or financing activities which NECPA intended to continue are not interrupted pending the development of these rules, *see* 44 FR 6378 (February 1, 1979), or the making of the requisite determination. Section 456.505 provides for waivers of the prohibition in § 456.502 (Section 216(a) of NECPA) upon the findings required by Section 216(e) of NECPA.

The determinations required by § 456.504 (Section 216(d) (1) and (2) of NECPA) have been delegated to the Office of Hearings and Appeals of DOE. This office has often been assigned responsibility for DOE adjudicatory determinations not required by statute to be made on the record. It has established procedures for such determinations and gained expertise in their utilization. Section 456.507(a) references that portion of 10 CFR where those procedures are found. Only one additional requirement is added to those procedures: a requirement that an applicant or petitioner give notice of his application or petition to the applicable Governor, State Energy Office, and State Regulatory Authority. This is to ensure that those State agencies with responsibility for the Residential Energy Conservation Program are apprised of a particular utility's desire to supply, install, or finance residential energy conservation or renewable resource measures.

The findings required by § 456.505 (Section 216(e) of NECPA) have been delegated to the Assistant Secretary for Conservation and Solar Applications who has overall program responsibility for the Residential Conservation Service Program.

The last exemption from the prohibition in Section 456.502 is an exemption for the supply, installation, and financing of residential energy conservation and renewable resource measures by a utility where a prior existing State law or regulation either required or explicitly permitted the utility to engage in such activity. The Conference Report on NECPA indicated that it was the conferees' intent that under certain circumstances measures merely "contemplated" by a State statute or regulation might be included within this exemption. DOE also learned that the State of Michigan had passed a law before the enactment of NECPA which authorized the Michigan public service commission to approve energy conservation programs, specifically indicating that the law was to qualify Michigan utility programs for certain Federal exemptions. The Michigan public service commission, however, did not act until after the enactment of NECPA. Section 456.506(a)(1) exempts utilities from the prohibition in § 456.502 where the State law or regulation is clear and unambiguous. However, it is apparent that it was NECPA's purpose to provide exemption in circumstances where the law merely "contemplated" certain measures or other circumstances where the effect of the State law or regulation might be unclear, as is the case with the State of Michigan. Section 456.506(a)(2) is intended to address such situations by enabling the chief law officer of the State to certify the the State law or regulation did indeed intend to require or permit the otherwise prohibited activity. Because the ambiguity would arise under State law, it is appropriate that the determination be made by a State officer.

Subsection (b) of § 456.506 is intended to clarify the last sentence of Section 216(f) of NECPA. That sentence does not exempt "programs" from compliance with Section 215 of NECPA. Rather it exempts from Section 215's requirements only those actual supply, installation, or financing activities which a utility is engaged in by reason of a State law or regulation in existence on November 9, 1978. Thus, utilities which are excepted from the prohibition in § 456.502 (Section 216(a) of NECPA) by reason of § 456.506(a) (Section 216(d)(3) of NECPA) still must fully comply with all the requirements of the State (or Nonregulated Utility) Plan described in Subpart C (or D, with respect to nonregulated utilities), but there is no requirement that the actual supply, installation, or financing activities conducted by the utility be included in the utility's program under the State Plan (or Nonregulated Utility Plan).

The effect of this requirement is that utilities which have "programs" that include utility supplied, installed, or financed measures authorized or required by State laws must still implement a Residential Conservation Service Program with respect to all suggested measures; that is, the utility must send a Program Announcement, offer an energy audit, and arrange installation and financing of all suggested measures, and these activities must conform to the requirements of the State Plan as described in Subpart C. When the utility's prior "program" is inconsistent with these requirements, the utility may have certain options. First, and presumably least desirable, the utility may be able to run two separate programs, one meeting the requirements of the State Plan and one which does not. Second, the utility may be able to adjust its prior "program" to conform to the requirements of the State Plan. Third, the utility may seek a Temporary Program exemption from certain of Section 215's requirements.

It is believed that the flexibility afforded the States under Subpart C (and nonregulated utilities under Subpart D) will enable State Plans to incorporate within their terms most existing utility programs (whether or not those programs were permitted or required by State law) with but minimal changes (although in many cases the measures covered by the prior program will have to be substantially enlarged). Where this is not possible, DOE expects utilities with substantial programs underway to seek temporary program exemptions.

DOE has not at this time proposed a regulation giving DOE broad authority to tailor Section 215's requirements in light of already ongoing "programs," whether or not those programs were required or permitted by State law. This is due to the belief

that much tailoring can be accomplished within the terms of State Plans and temporary program exemptions as well as the fact that Congress apparently saw no reason to provide for such a provision. DOE, however, solicits comments on the problem of incorporating existing programs, both those required or permitted by State law as well as those begun by utilities on their own initiative, into the RCS Program, in order to determine if the proposed regulations are sufficient in this respect or whether additional provisions are necessary.

### VII. Subpart F—Federal Standby Authority and Enforcement Provisions

Section 219 of NECPA provides procedures to insure that eligible customers the services of the Residential Conservation Service Program when a State or nonregulated utility fails to submit an acceptable Residential Conservation Service Plan or fails to implement adequately an approved Plan. The Secretary shall invoke the Federal standby authority whenever an acceptable plan has not been submitted by a State or nonregulated utility within the requisite time or whenever an approved plan is not being adequately implemented by a State or nonregulated utility. If a nonregulated utility is included in a State Plan that is not approved or is not implemented adequately, however, such nonregulated utility shall not be subject to the Residential Conservation Service Plan promulgated by the Secretary. In those cases the nonregulated utility shall prepare and submit a Residential Conservation Service Plan as required by Subpart D. The submission of that plan shall be within a reasonable period of time as determined by the Secretary.

Before the Secretary can determine that a State Plan is not being implemented adequately, Section 219 of NECPA accords the State a right to notice and an opportunity for a public hearing. Although Section 219 does not provide nonregulated utilities an opportunity for a right to notice and a public hearing before the Secretary determines that a plan is being implemented inadequately, DOE is not aware of any reason why the nonregulated utilities should be treated differently. Accordingly, DOE intends to treat the states and nonregulated utilities in the same manner when determining the adequacy of their respective implementation of approved Residential Conservation Service Plans.

Once a determination is made that Federal standby authority should be implemented, the Secretary shall promulgate a plan for covered regulated utilities in the given State or, by order, require nonregulated utilities to promulgate plans. The plans promulgated, or ordered to be promulgated, by the Secretary pursuant to Section 219 of NECPA will be consistent with the requirements of Subpart B and C or D, as appropriate.

Section 219 of NECPA establishes procedures for enforcing plans promulgated under the Secretary's standby authority. The enforcement provisions include a $25,000 civil penalty for violations of requirements of plans promulgated by the Secretary or of orders issued by the Secretary. The enforcement provisions of Section 219 also apply, as provided in Section 216(h), to violations by public utilities of the supply, installation, and financing prohibitions of Section 216.

DOE does not intend to issue more specific regulations concerning the invocation and implementation of Federal standby authority. We are of the opinion that it will be preferable for the Secretary to be able to respond to his Federal standby responsibility on an ad hoc basis.

We note that the Environmental Protection Agency (EPA) has had a similar standby authority for several years under the Clean Air Act amendments of 1970 and has not issued regulations pursuant to that authority. Nonetheless, it is DOE's understanding that EPA, pursuant to its standby authority, has rejected some State plans and we perceive EPA's actions as precedent for the Secretary's decision to not issue more detailed standby regulations pursuant to Section 219. If interested persons believe more detailed regulations are appropriate, their comments and suggestions as to the content of such regulations are solicited.

### VIII. Subpart G—Renewable Resource Installation and Material Standards

NECPA requires the Secretary to determine if safety and efficiency standards are necessary for "residential energy conservation measures," including renewable resource measures. If such standards are necessary, DOE must prescribe them by rule. DOE has examined the intended use of renewable resource measures, industry standards (both existing and those in development) and the potential for consumer dissatisfaction. DOE has also examined existing Federal Standards, such as HUD's Minimum Property Standard (MPS).

The voluntary standard system consisting of industry, labor, code officials, and consumers is represented on the Steering Committee for Solar Energy under the aegis of the American National Standards Institute (ANSI). This Committee has developed and is continuing to develop at an accelerated pace standards to meet the needs for solar technology and solar purchasers. Within this framework, testing and certification programs are now being developed to establish a uniform rating procedure and methods for presentation including product labels.

DOE is currently developing a Model Document for Code Officials on Solar Heating and Cooling of Buildings. This comprehensive document will address installation, materials and other subjects covered in building codes relating to solar energy. Although intended to be adopted by States and localities DOE will consider amending this rule to require adherence to the Model Document.

Based on the analysis of these various factors, DOE has determined that the HUD MPS adequately covers both the material and installation standards for solar domestic hot water and active solar space heating systems (including combinations thereof). The solar energy industry is currently developing labeling criteria and performance standards. When adopted by the industry these will be examined for adequacy and may be adopted as amendments to this rule. DOE felt that the presence and acceptance of the HUD MPS represented adequate consumer protection and procedural standards for this solar equipment. The HUD MPS addresses performance, safety and installation considerations and represents an adequate, comprehensive standard for the purpose of these rules. One exception to this statement is the HUD MPS's failure to address solar thermosiphen hot water heaters. DOE has not yet developed standards for these devices and a section of the rules is reserved for these standards.

The HUD MPS provides that certain exceptions or alternative approaches to the prescriptions therein are acceptable if approved by HUD. The HUD MPS, however, was developed as a standard for HUD programs, and it is appropriate for HUD to grant exceptions from its standards. The Residential Conservation Service (RCS) program, however, is not a HUD program, and HUD is not involved in its implementation. thus, it would be inappropriate for HUD to grant exceptions from standards for the RCS program. Accordingly, DOE has provided in § 456.702 that provisions in the HUD MPS that allow for exceptions or alternatives approved by HUD to do not apply under the RCS program. DOE solicits comments on this approach and any alternatives.

Voluntary consensus standards for wind systems are now being developed. DOE supports the development of these standards. Premature implementation of Federal standards may inhibit development of wind systems and result in unnecessary price increases.

However, wind energy systems present unique problems of safety, involving both the device itself and its location. Therefore, DOE has developed standards related to siting criteria and wind machine characteristics. In developing these criteria, DOE considered information available from Rocky Flats Lab and various States offering tax incentives for wind energy systems.

Passive solar space heating and cooling systems present special problems. First, it is a developing technology, and, as noted above with respect to wind systems, premature Federal standards could inhibit the growth of this field as well as unnecessarily increase costs. Second, there are numerous different devices which vary greatly in cost, heating/cooling output, and methodology. These factors, DOE believes, militate against prescribing any standard for installation or materials for passive systems at this time. DOE is continuing research in this area and intends in the future to prescribe standards for at least some passive systems. DOE solicits comments on this approach and any alternatives.

Swimming pool heaters using nonrenewable fuels or sources of energy are common in certain areas of the U.S. The use instead of solar energy to heat pools can result in significant energy savings in such areas. DOE has not yet determined what standards are necessary for this technology. Reseach, however, is continuing, and DOE intends to prescribe a standard for solar swimming pool heaters in the future. DOE solicits comments relative to solar swimming pool heaters.

## IX. Subpart H—Energy Conservation Material Standards

### BACKGROUND:

NECPA requires the Secretary of Energy to develop and publish standards that he determines are necessary to assure the safety and effectiveness of materials and products designated in NECPA as "residential energy conservation measrues".

In developing proposed standards for these materials and products, DOE has drawn upon work conducted by the National Bureau of Standards (NBS) under a DOE contract. This work was begun as part of the Weatherization Program in 1975. DOE has accepted most of the recommendations contained in the National Bureau of Standards Technical Note 982 entitled *Criteria for Retrofit Materials and Products for Weatherization of Residences* (September 1978). The original version of this NBS report, NBSIR-75-795, issued in 1975, was subjected to extensive public, industry and government review. The revised recommendations contained in NBS Technical Note 982 are based on available technical information on the properties and performance of retrofit materials and products.

The proposed rules also reflect the contribution of several other Federal agencies. Following the establishment of rules for the Weatherization Assistance Program for Low-Income Persons, (Federal Register June 1, 1977), DOE reviewed the standards for weatherization materials contained in those rules. DOE concluded that some of those standards failed to provide adequate test methods, specifications for certain types of insulation material did not exist and that there were conflicts where two or more standards were cited for the same insulation material. Therefore, an informal interagency committee, comprised of representatives from DOE, the NBS, Department of Commerce, the Department of Housing and Urban Development, the Consumer Product Safety Commission, the National Fire Prevention and Control Administration, the Federal Trade Commission, and the General Services Administration, was formed for the purpose of reviewing further weatherization material specifications. This interagency committee, following its consideration of alternative standards, concluded that the specifications should be amended to remove inconsistencies in the Federal specifiations cited, to eliminate references to irrelevant requirements in the federal specifications, and to include recently-developed fire safety test methods.

In November 1978, DOE issued a technical report entitled *Material Criteria and Installation Practices for the Retrofit Application of Insulation and Other Weatherization Materials* (DOE/CS-0051). The technical report, which was announced in the Federal Register (November 16, 1978), solicited written comments on the recommended material criteria and installation practices for materials and products suitable for residential retrofit application. The comments which DOE has received were reviewed and considered in drafting the proposed regulations on material standards.

### SCOPE OF THE PROPOSED REGULATIONS:

The standards being regulation apply to the following materials and products or components thereof:

- Cellulosic or wood fiber loose-fill thermal insulation.
- Mineral fiber loose-fill thermal insulation.
- Mineral fiber blanket or batt thermal insulation.
- Vermiculite thermal insulation.
- Perlite thermal insulation.
- Polystyrene thermal insulation board.
- Polyurethane and polyisocyanurate thermal insulation board.
- Urea formaldehyde foam insulation.
- Aluminum foil reflective insulation.
- Storm windows (aluminum, wood, and rigid vinyl frame).
- Storm and thermal doors.
- Caulks and sealants.
- Heat absorbing and heat-reflective glazing.
- Heating and air conditioning duct insulation.
- Water heater insulation.
- Load management devices.
- Clock thermostats.
- Aspects of Multiglazed insulating glass units for windows and doors.
- Automatic vent damper devices for use with gas-fired furnaces (electrically, mechanically and thermally activated).
- Vent dampers for oil-fired furnaces.
- Automatic gas ignition systems.
- Replacement oil burners.
- Replacement gravity and forced air central gas furnaces.
- Replacement gas-fired low pressure steam and hot water boilers.
- Replacement oil-fired central furnaces.
- Replacement oil-fired boiler assemblies.
- Replacement Heat Pumps.

### TECHNICAL ISSUES

A guiding principle in the preparation of these material and product standards has been to use either existing Federal specifications or commercial standards wherever they adequately address the question of safety and effectiveness. The Federal specifications used were originally promulgated by the U.S. General Services Administration (GSA) for government procurement only.

The following GSA Federal Specifications were used in whole or in part:

- HH-I-521E—Federal Specification for Mineral Fiber Blanket/Batt Insulation.
- HH-I-1030A—Federal Specification for Mineral Fiber Loose-Fill Insulation.
- HH-I-515D—Federal Specification for Wood Fiber, or Cellulosic Loose-Fill Insulation.
- HH-I-574B—Federal Specification for Perlite Insulation.
- HH-I-585C—Federal Specification for Vermiculite Insulation.
- HH-I-524B—Federal Specification for Polystyrene Insulation Board.
- HH-I-530A—Federal Specification for Polyurethane and Polyisocyanurate Insulation Board.
- HH-I-1252B—Federal Specification for Aluminum Foil Reflective Insulation.
- TT-P-00791B—Federal Specification for Putty.[1]

[1] Used in whole.

● TT-G-410E—Federal Specification for Glazing Compound.[1]
● TT-C-00598C—Federal Specification for Oil and Resin Base Caulks.[1]
● TT-S-00230C—Federal Specification for Acrylic Sealant.[1]
● TT-S-001657—Federal Specification for Butyl Rubber Sealant.[1]
● TT-S-00230C—Federal Specification for chlorosulphonated Polyethylene Sealant.[1]
● TT-S-00227E—Federal Specification for Polysulfide Multicomponent Sealant.[1]
●TT-S-001543A—Federal Specification for Silicone Sealant.[1]

Commercial standards and test methods cited in this proposal were drawn from the following sources:

● American Society for Testing and Materials (ASTM) standard specifications.
● American National Standards Institute (ANSI) product standards.
● Underwriter Laboratory (UL) product standards.
● Industry standards of trade associations (such as the National Woodwork Manufacturers Association or the National Electric Manufacturers Association).

The American Society for Testing and Materials (ASTM) is a scientific and technical organization that establishes voluntary consensus standards for materials and products. ASTM operates through approximately 120 technical committees and sponsors more than 125 research projects to develop new test methods and material standards and to improve existing test methods and standards. ASTM has developed more than 5,200 standard test methods. ASTM members are engineers, scientists and skilled technicians. Private firms, government agencies, as well as individual memberships, are recognized.

The American National Standards Institute (ANSI) is a voluntary federation whose purpose is to bring to bear on standardization needs the cooperative efforts of commerce and industry, standards-developing organizations, and consumer interests. ANSI also provides a recognized mechanism in the United States for establishing consensus standards. This consensus mechanism requires that every proposed standard submitted to ANSI for approval be subjected to a period of public review and comment. During this period any interested person may obtain a copy of the draft and submit comments which must be considered by the originating committee. ANSI's Board of Standards Review then determines, on the basis of evidence presented, if national consensus exists.

Underwriter Laboratory is a not-for-profit independent organization for testing products for public safety. It maintains and operates laboratories for examining and testing of devices, systems, and materials to determine their relation to life, fire and casualty hazards.

Some of the proposed standards contain new provisions that are not drawn from either Federal Specifications or commercial standards. The procedure for determining settled density of cellulosic loose-fill insulation is an example of such a new provision.

DIFFERENCES BETWEEN DOE PROPOSED STANDARDS AND GSA FEDERAL SPECIFICATIONS

Materials used for thermal insulation should meet requirements for thermal resistance,[2] fire safety, noncorrosiveness, and resistance to moisture absorption, odor-emission and fungi. Although GSA Federal Specifications are available which contain requirements for most of these material properties, the GSA Federal Specifications for mineral fiber loose-fill and mineral fiber blanket insulation do not contain standards for resistance to fungi and odor. The DOE standards, however, do contain these provisions.

The following Federal Specifications currently require that the fire performance of the various insulation materials be evaluated according to the test procedures described in ASTM E84 "Surface Burning Characteristics of Building Materials": HH-I-521E (Mineral Fiber Blankets/Batts); HH-I-1030A (Mineral Fiber Loose-Fill); HH-I-524B (Polystyrene Board). The NBS, which is the recognized fire safety research arm of the federal government, has judged that there are certain insulation applications for which the ASTM E84 test method does not adequately assess the response of insulation to flame and heat. The NBS has therefore recently developed two new fire safety test procedures: the critical radiant flux test and the smoldering combustion test. The GSA has included these two test methods in its specification for Cellulosic Loose-fill Insulation, HH-I-515D. The proposed DOE standards differ from existing[3] GSA Federal Specifications in that the DOE standards also require these tests for mineral fiber loose-fill and blanket insulation and aluminum foil reflective insulation. The proposed DOE standards for Polystyrene, Polyurethane, and Polyisocyanurate Insulation Board also require the smoldering combustion test whereas the GSA Federal Specifications for these materials do not. DOE believes that the smoldering combustion test is necessary to assure the fire safety of these materials.

[2]The thermal resistance of a given piece of insulation is designated as its "R-value".

[3]DOE has been informed that GSA will be proposing the same changes in its Federal Specifications.

STANDARDS FOR THERMAL INSULATION

● Mineral Fiber Blanket Insulation

After consulting with the staffs of the Consumer Product Safety Commission (CPSC), GSA, and the FTC, DOE is proposing regulations with respect to fire safety of mineral fiber blanket/batt insulation (including fibrous glass) that are consistent with the positions of these agencies.[3] The CPSC has considered the alleged risk of injury from fire associated with the membrane covering of fibrous glass insulation in Petition CP-77-1 (Metropolitan Denver District Attorney's Consumer Office in re: Hazards in Home Insulation). The CPSC decided that, based on available information, an unreasonable risk of injury form fire is not associated with the membrane-covering of mineral fiber blanket/batt insulation and that a mandatory standard is not necessary for the covering.

While the proposed standards do not require the membrane covering for mineral fiber blanket/batt insulation to be tested for fire resistance, DOE will consider any evidence of incidents involving fires in which membrane-backed mineral fiber insulation was a contributing factor and solicits comments on this issue. However, mineral fiber blanket insulation that requires breather papers for application purposes is required to be fire-resistant, because breather papers are exposed after installation.

● Mineral Fiber Loose-Fill Insulation

The DOE is currently developing a new procedure for determining the design density of mineral fiber loose-fill insulation. Density determination is important because other material properties, such as thermal resistance, vary with density. The current GSA specification for mineral fiber loose-fill insulation (HH-I-1030A) contains a procedure for density measurement which does not account for the effects of settling. DOE believes that the new procedure will measure densities of mineral fiber loose-fill insulation more accurately than the GSA procedure. The test procedure will be proposed for public comment at a later date.

● Cellulosic or Wood Fiber Loose-Fill Insulation

Federal Specification HH-I-515D, which superseded HH-I-515C on June 15, 1978, is the current GSA specification for loose-fill cellulosic insulation. It contains physical property requirements for thermal resistance, fire safety, corrosion-resistance, resistance to moisture absorption, odor emission and fungi, and a procedure for determining settled density. Fire safety tests required by HH-I-515D are the critical radiant flux and smoldering combustion test. The Department of Housing and Urban Development cur-

rently uses HH-I-515D as the Minimum Property Standard for cellulosic insulation. The previous Federal Specification (HH-I-515C) required a different fire safety test method (ASTM E 84) and corrosion-resistance test.

On July 11, 1978, the Emergency Interim Consumer Product Safety Standard Act of 1978, Pub. L. 95-319, became law. This legislation amended the Consumer Product Safety Act (15 U.S.C. 2051 *et seq.*) by adding section 35 that required the CPSC to issue an interim consumer product safety standard for cellulosic insulation, based on the requirements for flame resistance and corrosiveness in the GSA specification HH-I-515C. Pub. L. 95-319 modified flame spread classification to Class 25 only using the screen correction factor required in ASTM C739-77. Pursuant to the statute, the CPSC published on August 8, 1978, the interim consumer product safety standard addressing the flammability and corrosiveness of cellulose insulation (43 FR 35240). The interim standard applied to all cellulosic insulation manufactured after September 7, 1978.

The Emergency Interim Consumer Product Safety Standard Act of 1978 also provides that, until a final consumer product safety standard is in effect, the CPSC must publish for public comment any amendments to the interim standard the GSA issues that supersedes the requirements for fire resistance and corrosiveness in Federal Specification HH-I-515C. The GSA has informed the CPSC that, effective June 15, 1978, it has issued GSA Specification HH-I-515D. Since this specification contains requirements for fire resistance and corrosiveness for cellulosic insulation that supersede the requirements in HH-I-515C, the CPSC is required to publish the fire resistance and corrosiveness provisions of HH-I-515D as a proposed amendment to the interim standard and receive comments thereon. Comments on the CPSC proposed amendment to the interim standard will be completed in June 1979 and CPSC expects to publish the final standards in September 1979.

To assure conformance between DOE and CPSC proposed standards for loose-fill cellulosic insulation, this proposed rule contains requirements for fire safety, corrosion-resistance, and a procedure for determining settled density that are identical to those in the CPSC proposal. The proposed standard for cellulosic or wood fiber insulation contains a requirement for flame resistance permanency which is designated "reserved." According to the CPSC, questions have emerged about the life span of boric acid, the flame retardant most commonly used in cellulosic insulation. There is currently no satisfactory method for testing the flame spread permanency of cellulosic or wood fiber insulation. The proposed DOE standard indicates that such a test is "to be determined." The other material standards for loose-fill cellulosic insulation (thermal resistance, and resistance to odor emission, moisture absorption, and fungi) contained in this proposed rule will be unaffected by the CPSC actions.

DOE is proposing in this regulation a new procedure for determining the settled density of cellulosic loose-fill insulation, called the "cyclone-shaker" method. Density determination is important because other material properties, particularly thermal resistance, vary with density. The current GSA specification (HH-I-515D) contains a procedure that requires 28 days to run. DOE believes that its proposed procedure of much shorter duration measures density with equal accuracy.

● Urea-Formaldehyde Foam Insulation

Following the advice of the interagency task force on material standards, DOE has developed a material standard for Urea-formaldehyde (UF) foam insulation. There are two problems associated with the use of UF foam insulation.

● Formaldehyde vapor is sometimes given off in small quantities from UF foam insulation. This vapor has a noxious odor and can irritate the eyes and respiratory tract. The health effects from exposure to a particular level of formaldehyde vapor vary greatly from person to person.

● UF foam shrinks during setting, reducing the insulation's thermal resistance. The shrinkage rate and its effect on thermal resistance reduction have been estimated by the NBS and the method for determining thermal resistance adjusts for this effect. In addition, a DOE study is underway to measure the shrinkage rate of UF foam insulation and its effect on thermal resistance.

DOE has several studies underway to determine the factors which may contribute to the release of formaldehyde vapor in houses insulated with UF foam. Sufficient data has already been obtained to link this formaldehyde problem to several specific factors:

● Excessive free formaldehyde content of the resin

● Improper ratio of resin to foaming agent

● Installation under improper temperature conditions

● Installation in improper locations.

The DOE believes that these problems are preventable by means of adequate material standards and installation requirements. The standards for UF foam insulation contained in these rules, which are identical to the Canadian UF Foam Standard, are proposed as interim standards pending completion of the above-mentioned DOE studies. The Canadian standard is used because the Canadian Government has reported a significantly lower rate of formaldehyde vapor incidents than have been reported in the United States. However, if we find substantial evidence of significant health problems with this standard, it will be removed from our rules. We seek comments on this approach.

### FIRE SAFETY TESTS

The three fire safety requirements contained in these proposed standards are: Critical radiant flux, smoldering combustion, and surface burning characteristics. The NBS has recently developed test methods for the first two requirements. The ASTM test method for determining surface burning characteristics (ASTM E84) has been in use for several years.

Critical radiant flux is the level of incident radiant heat energy on the insulation below which flames will cease to propagate. For insulation used in open attic floors the critical radiant flux should be equal to or greater than $0.12 W/cm^2$. The critical radiant flux should be determined by the attic floor radiant panel test procedure described in § 456.803(d)(3) of these proposed regulations. This test method provides a basis for evaluating the surface flame spread behavior of attic floor insulation in a building attic.

The smoldering combustion test determines the tendency of the insulation to support and propagate smoldering combustion subsequent to exposure to a standard localized ignition source. The smoldering combustion test procedure is described in § 456.803(d)(4) of these proposed regulations.

The ASTM E 84-77 flame spread test method should be the basis for evaluating surface burning characteristics. This test method is recommended for polystyrene, polyurethane, and polyisocyanurate insulation board, and aluminum foil insulation.

### Products Not Covered by Federal Specifications or Standards

There are no Federal Specifications or Standards for the following products:

● Storm and thermal doors
● Storm and thermal windows
● Clock thermostats
● Multiglazed insulating glass units for windows and doors
● Heat absorbing and heat-reflective glazing
● Heat pumps
● Load management devices
● Vent dampers
● Automatic gas ignition devices
● Replacement oil burners

- Replacement central gas and oil-fired furnaces, and
- Replacement boilers

The accepted industry standards for storm doors and windows, thermal doors, and clock thermostats are proposed for adoption by DOE. The DOE is proposing to adopt existing American National Standards Institute (ANSI) standard for automatic vent dampers on gas, automatic gas ignition devices, oil burners, replacement central gas and oil-fired furnaces, and boilers. A proposed Underwriters Laboratory standard is proposed for heat pumps and vent dampers on oil-fired appliances. DOE is proposing a proposed ASTM standard for the sealant on organically sealed multiglazed insulating glass units.

No Federal specification or standard and no commercial standard exists for load management devices. DOE is proposing performance criteria for such devices, including requirements that the devices have Underwriters Laboratory approval and be accepted by the local electric utility, in lieu of specific material standards. Comments are solicited on this approach and its sufficiency.

With respect to weatherstripping and glazing compounds, DOE has determined that no standard is necessary for the RCS program as commercially available materials are suitable.

With respect to pipe insulation and energy usage display meters, DOE has not yet determined whether standards under the RCS program are necessary. Comments on this are solicited.

Finally, with respect to thermal windows, DOE believes that standards are necessary. We are evaluating various existing consensus or voluntary product standards for inclusion in the final rule.[4] We seek comments on what standards are appropriate for thermal windows.

## X. Subpart I—Energy Conservation Installation Standards

### BACKGROUND

NECPA requires DOE to promulgate standards which the Secretary determines to be necessary to assure the safe and effective installation of materials and products designated in the Act as "residential energy conservation measures."

In order to carry out the task for developing the necessary installation standards, an informal interagency committee was established which included staff from DOE, the National Bureau of Standards (NBS), the Consumer Products and Safety Commission (CPSC), and the Federal Trade Commission (FTC). This Committee conducted an intensive search for existing standards for the installation of these materials and concluded that the few which existed were not adequate to ensure the safety and effectiveness of the installed materials. However, in the course of this research it was determined that various manufacturers and trade associations had developed installation instructions and recommendations for their products. The Committee evaluated these but concluded that in many cases they did not sufficiently address areas which the Committee felt were necessary to assure the safety and effectiveness of installations. Nevertheless, since these guidelines contained much relevant information, they were used as a cornerstone for the Installation Practices proposed herein. These guidelines are available in DOE's Docket File.

The Committee's task of developing comprehensive Installation Practices for insulation materials was especially difficult since there exist no standardized criteria by which to determine what constitutes proper or improper installation. Furthermore, many issues which relate to the safety and effectiveness of installations remain unresolved even though extensive and varied research has been conducted in both the public and private sectors. To a large extent this is due to the complexity of building behavior which appears to be shaped by environmental variables and occupant lifestyle as well as the building components themselves. The changes which take place in a building when insulation is added have been difficult to predict. Certain procedures, such as the addition of vapor barriers, blocking, or ventilation, may prevent the occurrence of some undesirable effects but much controversy exists over when such measures are necessary. The Committee has made a number of technical determinations on the basis of existing research results to produce Installation Practices directed at minimizing the occurrence of undesirable effects while maximizing safety and effectiveness. These determinations are discussed in further detail below, in the section entitled "Technical Issues."

DOE originally released certain of its recommended Installation Practices in November 1978 in a Technical Report entitled "Material Criteria and Installation Practices for the Retrofit Application of Insulation and Other Weatherization Materials" (DOE/CS-0051). This Technical Report, which was announced in the Federal Register (November 16, 1978), solicited written comments from interested parties. Written comments which were received prior to January 30, 1979, have been evaluated by the Committee and responses have been sent to the appropriate group. The Practices contained herein reflect many of the substantive comments (See "Technical Issues" below).

### PROPOSED REGULATIONS

Installation Practices are proposed in this regulation for the Residential Conservation Service Program for the following materials and products:

- Organic and mineral fiber loosefill thermal insulation
- Mineral fiber batts and blanket thermal insulation
- Organic cellular rigid board thermal insulation
- Mineral cellular loosefill thermal insulation
- Reflective insulation
- Storm windows, thermal windows, multiglazing units, heat absorbing/heat reflective glazing, and storm doors and thermal doors
- Clock thermostats
- Insulation on gasfired, oilfired, and electric resistance water heaters
- Replacement oil burners

DOE made a technical determination with respect to organic and mineral fiber loosefill materials to include these in a single installation standard. This determination was made on the basis of the methods of application and intended application of both materials. DOE concluded that differences between the two are minimal in these areas and that these differences could be addressed where necessary by a single Installation Practice.

DOE also made a determination not to include Installation Practices for caulking, sealants, and weatherstripping materials. DOE concluded that Installation Practices for these materials are unnecessary since improper installation will not produce potentially hazardous situations. In addition, any information which DOE could provide relative to proper installation for effectiveness may only duplicate existing manyfacturers' instructions.

The proposed regulations do not contain Installation Practices for replacement furnaces and boilers (including heat pumps), load management devices, and energy usage display meters because DOE has not yet made a determination whether installation standards are necessary for these items.

DOE has not yet developed Installation Practices for vent dampers, automatic ignition devices, urea-based foam insulation, and pipe insulation. Standards for these devices will be completed in the near future, and a reasonable opportunity will be provided for comment prior to final rulemaking. The American National Standards Institute (ANSI) recently promulgated material standards for vent dampers with accompanying in-

[4] In particular, we are considering adoption of AAMA Standard 1502-6-1977, (Voluntary Standards and tests of Thermal Performance of Residential Insulating Windows and Sliding Glass Doors.)m

stallation guidelines. DOE evaluated these guidelines and concluded that they did not adequately ensure a safe and effective installation. DOE was especially concerned that these guidelines did not sufficiently address the intended uses of the devices and their compatibility with other systems. DOE expects to develop standards for the safe installation of vent dampers in the near future.

DOE made other general determinations in the preparation of these Installation Practices. Since these Practices are addressed to professional installers under the Residential Conservation Program, DOE assumed that the installers possess a working knowledge of the methods necessary to carry out the installations or will be supervised by someone who possesses such knowledge. Therefore, rather than provide step-by-step installation instructions, these Practices present only the requirements intended to promote safe and effective installation. Furthermore, since the phrase "safety and effectiveness" was interpreted as meaning safety to the occupants of the building rather to the installer, a determination was made not to include provisions relating to the installer's safety. Requirements pertaining to the safety of persons installing many of these materials currently exist under Occupational Safety and Health Administration (OSHA) regulations.

While DOE has attempted to maximize the accurence of safe and effective installation through these Practices, it must be noted that these Practices cannot cover every situation. The U.S. building inventory is characterized by many types of construction, and some of it is relatively old. It is inevitable that installers will encounter situations which differ from those described in these Practices. In such cases they will need to rely on their judgment to take additional precautions to ensure that the materials are installed in a manner which does not compromise their safety or effectiveness.

### TECHNICAL ISSUES

*Insulation.* Each of the Installation Practices is based on the best technical information available. However, because standardization in the area of installation does not exist, there are areas of conflict where judgments had to be made. Comments submitted as a result of the Technical Report showed that the following areas caused the most concern:

a. *Pre-Inspection/Post-Inspection.* In each Practice, the installer is required to conduct his own pre- and post-inspection. This is done to insure his awareness of potential problems while they may be easily corrected and to provide a checklist at the end of the job to assure a safe installation has taken place.

b. *Heat-Producing Devices.* These devices include, but are not limited to, recessed lighting fixtures (with attached wiring compartments and ballasts), motors, fans, blowers, furnaces, chimneys and flues. The Practices require identification of these devices and a 3-inch air space separating them form the thermal insulation. Exceptions to the 3-inch air space requirement with respect to flues and chimneys are made for mineral fiber loosefill and unfaced batt and blankets, and mineral cullular loosefill because the materials are noncombustible when tested in accordance with ASTM E136. The 3-inch air space around recessed light fixtures and the prohibition against covering these fixtures, (with attached wiring compartments and ballasts) are both contained in the National Electric Code (Article 419.66).[5] They have been included in the proposed Practices since the covering of fixtures with insulation may lead to their overheating and the creation of associated fire hazards. When loosefill insulation is used, barriers must be installed around the heat source to ensure that the air space is maintained. The Technical Report did not include the use of unfaced mineral fiber batts as a barrier. The proposed Practices contained herein have been revised to include this material as a barrier.

c. *Prohibition Against Additional Wall Insulation.* The Installation Practices prohibit the application of insulation material in wall cavities which have been previously insulated. This is based upon three criteria:

- Additional wall insulation is not generally cost effective. To a large extent, the cost of additional insulation is attributable to the labor involved in the installation process. The addition of such material is unlikely to provide energy savings sufficient to offset the installation cost. This determination with respect to cost-effectiveness is supported by an economic analysis performed by NBS "Retrofitting Existing Housing for Energy Conservation," Building Science Series 64, NBS, Department of Commerce, Washington, D.C., (December 1974) which concluded "• • • if any insulation exists (in walls), blown-in insulation is not practical and unlikely to be cost-effective." (Ibid. P. 45).
- Homeowners often do not know if wall insulation is present, or, if present, how much. It is therefore difficult for them to determine the cost-effectiveness of adding more.
- Installing wall insulation in a cavity where some exists greatly reduces the potential for an effective application since existing insulation restricts the access to the wall cavity.

d. *Moisture Transmission and Vapor Barriers.* There has been much controversy about the need for vapor barriers. A typical family of 4 may produce as much as 18–20 lbs or more of water vapor per day, if humidifiers, automatic washers and clothes dryers are used. This moisture is transporter in one or more of the following three ways: By exfiltration or ventilation, by diffusion through envelope materials, or by condensation on windows or other cold surfaces. The "Report on Control of Condensation in the Walls and Ceilings of Retrofitted Homes," issued by NBS in December 1978, shows that the amount of moisture accumulation depends on the geographic location, indoor humidity level, and relative air moisture permeances of the inside and outside parts of the wall.

Vapor barriers have traditionally been used to retard the flow of moisture through walls and ceilings. The application of vapor barriers (in the form of low permeability paints or wallcoverings) in a retrofit situation is an expensive and time-consuming process and should not be required unless it can be shown that homes without vapor barriers are likely to experience moisture problems. Moisture problems may include deterioration or rot of wood structures or paint failures. Because geographic locations, and to some extent indoor humidity levels, are the only variables which can be easily identified, DOE based the requirement for vapor barriers on these. Vapor barriers are required in the walls and ceilings of bathrooms and unvented high-moisture areas in condensation Zone 1 as reflected in Figure 1 of the Installation Practices because condensation is most likely to occur here. Vapor barriers are not required on the ceilings in these rooms as long as some attic floor insulation existed previously. In addition to the vapor barrier requirements in Zone 1, contractors are required to caulk cracks around windows, wall outlets, ceiling fixtures, and between walls and ceilings, and walls and floors. This requirement was included because most experts agree that air leakage through cracks and openings in interior wall surfaces is a more significant moisture transfer mechanism than diffusion through wall coverings. The requirements for a vapor barrier is only effective if it is accompanied by a means

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[5] The National Electrical Code (NEC) is sponsored by the National Fire Protection Association under the auspices of the American National Standards Institute (ANSI). The purpose of the Code is "the practical safeguarding of persons and property from hazards arising from the use of electricity • • • The Code contains provisions considered necessary for safety." The NEC is available from the National Fire Protection Association, 704 Atlantic Avenue, Boston, MA 02210.

for sealing air leakage paths. Although DOE recognizes that moisture originating in bathrooms and laundry areas will not be confined there, it is felt that once moisture laden air leaves these areas, it will be sufficiently diluted so that the potential for moisture-related problems is minimal.

For condensation Zone 2, where the incidence of condensation is less prevalent, the requirements of Zone 1 have been included as recommendations. DOE opted to recommend rather than required these procedures since the need for such procedures is inconclusive in Zone 2. Instead, the installer is required to inform the homeowner of the options and to let such homeowners make the final decision about what precautions to take.

e. *Ventilation Requirements.* The required levels of free attic ventilation area are identical to the HUD minimum Property Standards. Although these levels are widely accepted, DOE recognizes that there may be circumstances where it is not practical to adhere to them too rigidly. If, for instance, a contractor finds slightly less than the recommended ventilation area, it may not be practical or necessary to add more. DOE solicits comments on how such flexibility might be built into the Practices. It is not necessary that the insulation and ventilation be installed at the same time. If weather conditions make ventilation installation impractical, this part of the contractual obligation may be completed within 6 months after the insulation has been installed.

f. *Insulation Over Wiring.* Laboratory tests conducted by NBS show that when thermal insulation is placed around electrical wiring, heat dissipation is restricted and resulting wiring temperatures exceed those allowed by the National Electrical Code (NEC) or Underwriter's Laboratory (UL) (See NBSIR 78-1477, "Exploratory Study of Temperatures Produced by Self-Heating of Residential Branch Circuit Wiring When Surrounded by Thermal Insulation"). NEC requires that the type of electrical wiring often found in existing residences not be operated at temperatures in excess of 140°F (Tables 310-16 through 19). When parallel nonmetallic sheathed cables carrying 135 percent of rated current were placed between two layers of R-11 insulation, NBS found that temperatures of 298°F were reached. The highest temperatures appear to occur when the electrical system is overfused. CPSC conducted a survey of low-income homes in several cities in the U.S. Among the samples surveyed in each city it was found that more than 50 percent of the homes, which use fusing as overcurrent protection, were overfused.

Overheated wiring circuits may ignite electrical insulation or adjacent building materials, or they may lead to gradual deterioration of the electrical system since the excessive temperature will cause the electrical insulation to degrade. This condition creates a significant fire hazard from arcing or shortcircuits. To insure that these hazardous situations do not occur, DOE has included provisions in the Installation Practices which effectively prohibit insulation from covering attic wires.[6] Although DOE recognizes the severity of these contraints, there is also a need to consider the long-term problems which may arise for homeowners and consumers. Many questions remain unanswered regarding the relationship of laboratory tests to real-life situations and regarding characteristics of wiring covered by thermal insulation. DOE, NBS, CPSC, and Community Services Administration (CSA) are all embarking on research or demonstration projects in this area. The projects include:

- Laboratory studies on encapsulated wiring to determine the temperatures of encapsulated wiring under various loading conditions.
- Field studies in cooperation with various utilities to determine wiring temperatures reached and length of time the temperatures are sustained in actual homes.
- Field study of low-income homes to evaluate condition of attic wiring.
- Hot-line with fire marshalls to investigate causes and origins of electrical fires.

The timing of the research and regulations is such that results should be available prior to promulgation of the final rules. Results of the research will be included in the docket for the final rule. DOE will also take the results of this research into account in the final rule.

g. *Reflective Insulation.* Many comments on the Technical Report suggested that reflective insulation should not be recommended for use in this program. The commentors claimed that the material was less thermally efficient, more difficult to install, and less durable than the other suggested insulation materials. DOE is soliciting comments here on the desirability of retaining reflective insulation in the RCS Program.

h. *Diversified Testing Clause.* DOE is considering the inclusion of a diversified testing clause for determining whether a 15-minute finish rating is necessry for organic cellular rigid board materials. ASTM E119 is the test procedure generally used to determine the fire performance of these rigid board materials used in a wall system. In the test, the insulation board is covered by standard ½" gypsum board and subjected to temperature conditions specified in E-119. The gypsum board, acting as a thermal barrier, must prevent heat transmission sufficiently so that the backside of the thermal barrier is not greater than 250° F above ambient conditions for 15 minutes.

Some manufacturers and building code officials feel this test is not applicable to all rigid board materials in all situations. They feel that there are other tests and/or combinations of tests which more accurately portray the performance of the system. The following clause is therefore being considered for inclusion in the final rule in § 456.906:

> Insulation board materials may be excluded from this requirement where specifically authorized by local codes or regulations based upon specific materials used in specific applications where such exclusion is based on approved diversified tests such as, but not limited to, tunnel tests in accordance with ASTM E-84 or fire tests related to the actual end-use configuration such as a corner test and an ignition temperature test. Exclusions may be based on the end-use quantity, location and similar considerations where such tests would not be applicable or practical.

Determination for inclusion will be based on the following:

- Applicability to residential retrofit.
- Availability of criteria upon which to base "approved" diversified tests.
- Impact upon other types of insulating materials used in similar applications.

DOE is aware of concern over the intended use of this clause and potential abuses of it. However, the diversified testing clause would provide compatibility with some building codes. DOE is, therefore, requesting comments on this issue:

i. *Wiring Examination.* DOE considered requiring insulation contractors to examine the condition of exposed attic wiring for fraying, cracking, or missing electrical insulation. Insulation placed over deteriorated wiring may:

- Accelerate further deterioration of the wire,
- Promote smoldering, or
- Promote possible ignition of insulation or structural members.

By incorporating the wiring provisions described in (f) above, the wiring examination no longer serves as a useful function since insulation can no longer cover attic wiring. If the test results described in (f) show that placing thermal insulation over wiring does

[6] An exception is made to this provision when wiring is attached to attic joists and when there is proper over-current protection. The exception is made because the joist serves as a heat sink and dissipates heat which otherwise would result in excessive temperatures.

not cause potential safety hazards, then a requirement for a wiring examination may replace the provisions included in § 456.904(e)(6).

j. *Installer Certification Card.* DOE is requiring that a certification card be completed with the installation of insulation for the following reasons:

- Because insulation is installed in areas not easily visible to the homeowner, the homeowmer needs some record of what was installed.
- The certification card will provide information (that may not be passed on by the present owner) to future residents of the home.

#### WATER HEATER INSULATION

DOE has, in this proposed Practice, prohibited the installation of insulation around gas-fired water heaters which have a flue damper attached. This determination is based on the fact that the flue damper significantly reduces the loss of heat through the flue, allowing more heat to be available for water heating. The potential for overheating of units is greatly increased by the application of additional insulation since other channels of heat-loss are eliminated. This provision does not imply that DOE is recommending flue dampers on water heaters.

#### REPLACEMENT OIL BURNERS

a. *Replacement Criteria.* DOE believes that definitive criteria are needed to determine those situations when a replacement oil burner will pay for itself over its useful life. Few homeowners are knowledgeable enough about furnace efficiency to make judgements about this investment. The replacement criteria are based on economics—as are other key elements of the program including the home energy audit. Replacement criteria are not included for other measures because, for the most part, those measures are not replacements, but additions.

b. *Certification Card.* Information is to be left with the installed unit similar to the certification card left by the insulation installer. Besides providing a record to the homeowner on the product installed, it will also aid any future servicemen who install the next burner by eliminating some of the guesswork necessary for the trial and error selection of the appropriate nozzle size.

c. *Coordination with Residential Tax Credit.* Performance criteria for a replacement oil burner under the Residential Energy Tax Credit (Title I, NECPA) may require an 82 percent steady-state efficiency when tested by the manufacturer on a new furnace. The Installation Practices contained herein require that the new burner have a steady-state efficiency of 75 percent when installed on an existing furnace or boiler. In addition, the increased efficiency of the new burner over the old burner must be sufficient to pay for the new burner over the expected life. For example, this means that if the steady-state efficiency with the existing burner is 55 percent and the steady-state efficiency with the new burner is 75 percent, the energy cost savings associated with the increased efficiency must be greater over the useful life of the replacement burner than its installed cost.

DOE does not feel these criteria are inconsistent with those in the tax credit. DOE is interested in the efficiency of the actual furnace system, not the ideal measured under laboratory conditions. In addition, DOE wants to insure that replacement oil burners are installed only when it can be demonstrated that the increased efficiency is sufficient to offset the cost of the installation.

## XI. Regulatory Analysis

The President, by Executive Order 12044, has directed agencies of the Executive Branch to conduct a Regulatory Analysis of regulations which they prepare that are likely to have a major economic impact. An objective of the Regulatory Analysis is to examine alternative regulatory provisions which might permit achievement of the regulatory goals at a lower cost. The Department of Energy has expanded this objective for regulations within its jurisdiction to require analyses of the impact of regulatory alternatives on the goals of the National Energy Plan.

In keeping with these objectives, the Department of Energy (DOE) has prepared a Draft Regulatory Analysis of its proposed rules to implement Title II, Part I (the Utility Program) of the National Energy Conservation Policy Act (NECPA). The rules provide for a Residential Conservation Service (RCS) Program to promote the installation of weatherization measures, energy-saving heating system modifications and renewable resource systems in residences.

The rules implement that portion of the National Energy Plan which has as its goal the installation of insulation and other energy conservation measures in 90 percent of American homes, exclusive of those to which the new building performance standards of the Energy Conservation and Production Act (ECPA) apply. The proposed rules provide for the preparation and administration by certain utilities and home heating suppliers of programs of consumer information and residential energy conservation designed to achieve this goal. These programs must conform to the Residential Energy Conservation Plans to be prepared by each state, the Tennessee Valley Authority and in some cases, nonregulated utilities, in accordance with the RCS Program regulations. Preparation of Residential Energy Conservation Plans by the states or the TVA, however, is voluntary.

Electric and gas utilities, both regulated and nonregulated, above a certain size (covered utilities) must prepare and administer programs irrespective of their state's decision to prepare a plan. Home heating suppliers are given the opportunity to volunteer in preparing and administering programs only if their state prepares a plan covering them.

Homeowners who improve the energy efficiency of their homes under the auspices of a covered utility or home heating supplier program conforming to RCS Program requirements will be eligible for certain consumer service benefits. Suppliers, financers and installers of energy-conserving measures and renewable resource systems may become eligible to provide commercial services to homeowners who participate in a covered utility or home heating supplier program. To do so, they must agree to comply with certain requirements regarding the quality of the service they provide to program participants. These requirements are to be published by participating states in their Residential Energy Conservation Plans.

Separate Regulatory Analyses were conducted for the energy conservation portion of the RCS Program and the portion covering renewable resources. The two analyses are presented separately in this Summary. Sections A and B address the impacts of the energy conservation portion of the RCS Program. Section C addresses the impacts of the renewable resource portion of the program.

This Summary of the Draft Regulatory Analysis is published concurrently with the publication of the proposed rules for the RCS Program. A copy of the complete Regulatory Analysis may be obtained by contacting:

Mr. James Tanck, Director, Residential Conservation Service Program, Office of Assistant Secretary for Conservation and Solar Applications, U.S. Department of Energy, 20 Massachusetts Avenue, Washington, DC 20545, (202) 376-4708.

Public comment is invited on the content of both this Summary and the complete Draft Regulatory Analysis.

### A. ALTERNATIVES

#### 1. Provisions Having Proposed Alternatives

In developing the proposed rule, DOE selected eight provisions for which proposed alternatives could sig-

nificantly alter the impact of the program. Assessment of the impact of these alternatives is the principal focus of the Regulatory Analysis. The eight provisions cover the following regulatory content:

(a) The required scope of the RCS Program audit;

(b) The required scope of the energy conservation measures audit;

(c) The required scope and duration of the requirement for post-installation inspections;

(d) The required scope of the training required for energy auditors;

(e) The required scope of installation standards for loosefill insulation;

(f) The required material standard for putty;

(g) The required material standard for glazing compound;

(h) The required material standard for attic insulation.

### 2. Proposed Alternatives

For each provision either two or three alternative rule contents were proposed. The alternatives are described below.

a. *The required scope of the RCS program audit*

The energy conservation measures which must be included in the program energy audit offered to residential customers will be of two general types. The first type includes measures which directly conserve energy by reducing the energy required to maintain acceptable living conditions. These measures are referred to for the purposes of analysis as energy conservation measures. The second type includes those measures which conserve energy by substituting renewable energy resources for nonrenewable energy resources. These measures are referred to as renewable resource measures.

Three alternative combinations of these measures were proposed as the scope of the energy audit which a covered utility must offer to its customers under the program:

(1) Three separate energy audits: one each for suggested energy conservation measures, solar water heating, and all other renewable resource measures;

(2) One comprehensive energy audit which includes all categories of measures;

(3) Two separate energy audits, one for suggested energy conservation measures plus solar water heating and one for all other renewable resource measures.

b. *The required scope of the energy conservation measures audit*

The energy conservation measures that must be considered in a residential energy audit will be those that are "suggested" for each covered utility's service area. They will therefore be determined by the definition of "suggested" measures. Three alternative definitions were proposed:

(1) All measures which pay for themselves within 6 years or less;

(2) All measures which pay for themselves within their useful lives;

(3) All measures listed in the legislation.

c. *The required scope and duration of the post installation inspections*

Three alternatives were proposed for the required scope of the post-installation inspections:

(1) Require inspections of all furnace-related work and random inspections of 20 percent of all other installed measures;

(2) No inspection requirement;

(3) Require inspection of all installed measures.

Two additional alternatives were proposed regarding the duration of the requirement for post-installation inspections:

(1) The inspections are required for the duration of the program;

(2) After an unspecified initial period, states may, at their descretion, remove the inspection requirement.

d. *The required scope of the qualification for energy auditors*

Three alternatives were proposed for the qualification of energy auditors:

(1) Require a minimum level of specialized training such as that specified by the reference program (See Section III.B. below);

(2) Have no specialized training requirement;

(3) Require a minimum level of specialized training but permit the states to determine its content.

e. *The required scope of installation standards for loose-fill insulation*

Several requirements were proposed to govern the installation of loose-fill insulation. Which of these requirements will be specified for RCS Program installations is the subject of three alternatives:

(1) The first alternative would require the use of:

(a) Soffit vent baffles,

(b) Barriers around recessed lights,

(c) Minimum ventilation in attics,

(d) Vapor barrier on ceilings and walls in attics and bathrooms in Zone 1 only,

(e) Inspection for moisture damage,

(f) Inspection of the condition of attic wiring, and

(g) Wire guards.

(2) The second alternative would require the use of (a) through (e) above;

(3) The third alternative would require the use of (a) through (f) and include a restriction that all loose-fill insulation be below the level of any wiring.

f. *The required material standard for putty*

Three alternative material standards were proposed for putty. They are:

(1) Conformance to F.S. TT-P-00791B;

(2) Commercial availability; or

(3) Conformance to F.S. TT-P-00791B modified to allow the use of natural calcium carbonate.

g. *The required material standard for glazing compound*

Two alternative material standards were proposed for glazing compound. They are:

(1) Conformance to F.S. TT-G-410E;

(2) Commercial availability.

h. *The required material standard for attic insulation*

Two alternative material standards were proposed for insulation that is to be installed in open attic floors:

(1) Critical radiant flux test and smoldering combustion test as described in F.S. HH-I-515D;

(2) Fire hazard labeling requirement.

## II. ANALYSIS OF ALTERNATIVES

### 1. Introduction

Choosing among alternatives is best facilitated by having available projections of the total program impacts due to each alternative. However, a special consideration arises in estimating the total program impacts when several sets of alternatives are involved and none of them are for provisions that encompass the entire rule.

The RCS provisions for which alternative rule contents were proposed are only parts of the larger body of provisions making up the entire rule. To obtain an estimate of the total program impact, the estimates for provisions that do not have alternatives proposed must be combined with estimates of the proposed alternatives for those that do.

Several of the latter provisions, i.e., those for which alternatives were proposed, have interactive effects. The impact of any alternative chosen for one affects the magnitude of the impact of an alternative chosen for another. Because of this interactive effect, the actual impact of some of these alternatives might differ from that estimated when each is assessed independently of the others.

In order to adequately capture these interactive effects, each alternative would have to be anialyzed in combination with each of the other alternatives with which it might interact. In the case of the alternaitves proposed for the Regulatory Analysis, however, the number of such possible combinations could be in the thousands.

Therefore, to make the analysis manageable, each provision for which alternatives were proposed was assessed individually. The effects of interaction which are necessarily omitted by this approach are not expected to be large. The results should be suitable for choosing among the alternatives proposed for each provision.

Given these considerations, a three-step approach was used to asses the impact of the total program and of each alternative. First, residential energy conservation activity in the absence of the RCS Program was projected through 1985. This baseline projection included consideration of existing federal, state and utility programs and trends.

Second, one combination of RCS Program provisions and alternatives was selected for analysis. This combination consisted of those program provisions for which alternatives were not proposed and alternative (1) in Section A above for each of the eight provisions for which alternatives were proposed. This combination of provisions and alternatives constitutes a reference program whose impact was estimated and them compared to the projected baseline in order to obtain an estimate of total program impact for one combination of alternatives. This has been termed the reference program impact estimate.

The third step in the analysis consisted of varying the alternatives, one at a time, and calculating the incremental differences from the reference program estimate. This step provided the results used in comparing the alternatives.

For some assessments, the assumptions underlying the data used permit direct estimation of the total program impact due to the alternative being assessed. For others, they do not. Therefore, the impact projections for some alternatives are reported in terms of the total program impact while for others they are reported at lower levels of aggregation. The reasons for this are explained in greater detail in the complete Regulatory Analysis. All results permit direct comparisons of the projected impacts for each alternative proposed for a provision.

The reference program estimate reported in this summary assumes that seven percent of the customers of a covered utility or home heating supplier will respond during each year of the program to the offer of an energy conservation measures audit. Seven percent is the maximum annual response rate expected for the case in which the audit is offered free of charge. This maximum likely response rate is based on the experience of a utiltiy which offered free audits as part of a retrofit program that was similar to the proposed RCS Program.

The rate of customer response to the offer of the RCS Program audit is a key variable for any projection of the program's likely impact. In order to provide estimates of the reference program's impact for other response rates, two other cases are analyzed in the complete Regulatory Analysis. In one of these cases, a lower annual response rate of 1.5 percent is used. This rate corresponds to the actual experience of several utilities for audits costing the customer $12. In the other, an annual response rate of 18 percent is used. This rate achieves the goal of the National Energy Plan of installing insulation or other energy conservation measures in 90 percent of existing American homes by 1985. For brevity, the results of these two additional cases are not presented in this Summary.

Another variable that is important to the analysis is the rate at which customers who have an audit follow up with the installation of energy conservation measures. Based upon the experience of a small number of utilities that have kept such records, this response rate has been assumed to be 75 percent. This follow-up installation rate was used for all three audit response rates. The effect of other programs, such as the energy tax credit, on these rates was not considered in the analysis.

All of the estimations presented in this Summary are based upon the assumed 7 percent annual audit response rate and a 75 percent follow-up installation rate. The results are presented by type of impact and sector impacted. The types of impact are: (a) Economic, (b) Energy.

The sectors impacted are: (a) National, (b) Governments, (c) Utilities, (d) Home heating suppliers, (e) Industry, (f) Households.

Two of these sectors are known to have some existing experience with residential energy conservation programs. The prior experience of state governments and utilties was taken into consideration in estimating the impact of the RCS Program on these groups. They were categorized according to three levels of prior activity in residential energy conservation programs. Estimates of impact for these groups are sometimes expressed in ranges which reflect prior level of activity.

The content of the reference program was chosen during the process of writing the proposed rules in order that the Draft Regulatory Analysis might serve as an aid in selecting the content of the proposed rules; therefore, it does not correspond precisely to the content of the rules as proposed. Consequently, the results reported for the reference program should not be interpreted as the projected impacts of the proposed rules. Rather, they reflect a set of program provisions that was selected to provide an analytical structure against which the alternatives were assessed.

Some alternatives do not produce incremental impacts for every sector. Therefore some sectors are omitted in the discussions of the alternatives.

### 2. Reference Program Impact Estimate

#### a. *Economic impacts*

(1) *National.* Total costs of developing and administering the five-year Residential Conservation Service Program are estimated to be $2 billion. This estimate includes costs to governments, covered utilities and home heating suppliers of participation in the program.

Households will invest an additional $6.7 billion in the purchase and installation of energy conservation measures. In return, they will realize an estimated gross savings in energy costs of $30 billion over the life of the measures installed.

The maximum energy savings likely to result from the RCS Program during the first year after the program has been completed are estimated to be 0.38 Quad (1 Quad = $10^{15}$ Btu) or 0.2 MBD (oil-equivalent). Total energy saved over the useful lives of all measures installed will be approximately 8.2 Quad.

To the extent that these energy savings reduce the rate of growth of petroleum imports, there will be a corresponding improvement in the national balance of trade position.

The RCS Program will result in additional employment by government, utilities, home heating suppliers and industry. In general these positions will be filled by skilled or professional personnel. They include, for each year of the program:

(a) 2,300 to 2,600 professional positions,

(b) 2,700 to 2,800 clerical positions,

(c) 8,600 auditors for conservation measures, and

(d) 500 post-installation inspectors.

The impact on employment in industry has not been estimated, primarily because of a lack of reasonably reliable data. In interviews, numerous industry personnel indicated their reluctance to hire additional labor or increase production significantly for a five-year program.

(2) *Governments.* Federal governments costs will be $21 million over the six years (FY 1979 through FY 1984) during which planning and administration of the RCS program are required. Approximately eleven additional professional staff members will be added.

State government planning and management requirements under the

program provide a number of options for the coverage and content of their Residential Energy Conservation Plans. These options include coverage of home heating suppliers and nonregulated utilities, and the choice of developing the audit procedures and training auditors or requiring the energy suppliers to perform these functions. The complete Regulatory Analysis includes estimates of state costs assuming several possible choices of content and coverage. The highest and lowest of these estimates indicate that total RCS Program costs to all states for the Years 1979 through 1984 will be in the range from $103 to $178 million. Because of uncertainty concerning which options would be chosen, an average cost has not been calculated.

Per capita program costs will be greater for states with small populations than for states with large populations. This is because the development of the Residential Energy Conservation Plan requires an equivalent level of effort by all states, regardless of their population characteristics. The five-year per capita impacts for large and small states under the least expensive combination of plan options are $.07 and $1.18 respectively. For the most expensive combination, the per capita impacts are $.34 and $1.98 respectively.

In the absence of federal funding, states may be required to increase revenue or cut spending in other areas to finance RCS Program activities. Spending cuts may result in reduced benefits to individuals who are affected by reductions in other state programs.

State planning and management requirements under the RCS program regulation will require an increase in professional state employment ranging from about 500 to 800 positions nationally for the years 1979 through 1984. The range corresponds to the estimates of lowest and highest plan costs discussed above. Approximately 300 additional clerical positions will also be required, resulting in total additional employment for all states between 800 and 1,100.

In addition to manpower costs, states may also be impacted by shortages of office space and equipment to accommodate the increased work force. These costs are not estimated in this regulatory analysis, but are recognized as a potential impact to some states.

Costs for enforcing compliance and reporting are included in the costs of plan development and plan management. It is assumed that the responsibilities of professional positions created by the program will be dominated by plan development and program initiation activities in 1979 and 1980. As the program progresses, enforcing compliance and reporting take on a more dominant role.

State regulatory authorities which are designated the lead agency by the Governor will be impacted at a level equivalent to that estimated for state energy offices. In cases where the regulatory authority is not designated as the lead agency, the authority is given the opportunity to review and comment on the state plan. This review function is not anticipated to be overly burdensome.

Additionally, regulatory authorities will be required to hear rate cases resulting from requests by covered utilities to expense program costs. These rate cases may result in more complex review procedures and a heavier work load for state regulatory authorities; however, no evidence was identified to indicate that this will have a significant impact.

The RCS Program regulation includes no direct role for local governments, except in the situation where a municipally-owned nonregulated utility which meets statutory sales criteria is not included in the state plan. In this situation the nonregulated utility would be required to complete those planning and management activities which would otherwise be completed by the state. There are approximately 35 municipally-owned nonregulated utilities covered by the regulation. While this impact is significant to those municipalities directly affected, on a national scale local governments will not be affected by the RCS Program.

(3) *Utilities.* The total costs of participation of the approximately 300 utilities covered by the RCS Program is estimated to be $1.6 billion. For a covered utility of average size (300,000 residential customers), the total costs for the five years of the program would range from about $3 million to $6 million depending on its prior level of activity. The average program cost for utilities is $5.3 million because few covered utilities have extensive prior experience in residential energy conservation activity.

Included in these costs are costs of providing a two-hour audit for conservation measures only, program information, arranging of installation and/or financing, and post-installation inspections. Additional skilled and professional personnel required each year for the RCS Program by a covered utility of average size would include:

(a) Up to 15 clerical and professional positions;

(b) 10 to 30 auditors for conservation measures only; and

(c) 1 to 2 post-installation inspectors.

The variations in costs and employment requirements depend on the utility's previous experience with a residential energy conservation program, such as whether or not home energy auditors have been actively employed, etc.

A covered utility's ability to fully comply with the rules may be constrained by a lack of a sufficient number of trained auditors. This constraint would arise if the response to the auditor training program is too low to meet the demand generated by the response to the program.

Excluded from these estimates are the additional costs to the approximately thirty-five nonregulated covered utilities for the additional planning activities they would have to undertake if their state does not include them in its plan for regulated utilities. These costs have not been estimated because of the difficulty in determining how many states would exclude nonregulated utilities from their plans.

Other impacts on covered utilities include the foregone alternative uses of the funds expended for the RCS Program. Such uses might include replacing equipment and increasing plant capacity. The latter impact would be negligible, however, if energy consumption by the residential sector is significantly reduced through the RCS Program.

The foregoing explicitly considers only those costs relating to the conservation measures audit. In addition, the utility is required to offer to its residential customers an audit for renewable resource measures. Because of its more general applicability, it is possible to provide one audit specifically for solar water heating. A third audit for all other renewable resource measures would be given separately for utility customers who have had the conservation measures audit. This arrangement would be costly to the utility as well as to consumers, for three separate visits to the home could possibly be required. This would increase labor time and travel time necessary to conduct the audit, and could inconvenience the homeowner by requiring multiple visits to the home.

Time required for each of the audits has been estimated to be two hours for the conservation measures audit, one and one-half hours for the solar water heating audit, and four hours for the audit of other renewable resource measures. At an estimated cost of $25 per audit hour, the cost of an audit package could vary from $40 or $50 for the solar water heating audit or the conservation measures audit to $190 for all three audits. Additionally, auditors trained for the solar water heating and other renewable resource audits would be required by the utility.

(4) *Home Heating Suppliers.* The total cost of participation of approxi-

mately 7,600 home heating suppliers which could be covered by the RCS Program is estimated to be $304 million. Based on an average dealer with 2,160 residential accounts, the total cost for the five years of the program per dealer would be approximately $40,000. Additional skilled and professional personnel required each year by the average dealer would be minimal:

(a) Less than 8 hours per week for clerical/professional staff

(b) About 8 hours per week time auditor capability

(c) Less than 4 hours per week for post-installation inspection staff.

The major impacts on home heating suppliers are likely to be: (a) reporting requirements, including additional paperwork and interactions with government staff, something with which the average dealer has little familiarity; and (b) possible anti-competitive effects from utility access to the customers of home heating fuel suppliers through a widely publicized and active utility program.

(5) *Industry.*

(a) *Energy Conservation Materials.* One of the major economic impacts will be the increased demand for energy conservation materials.

Sales of attic insulation will increase by $590 million over what would have been purchased in the absence of the program. For storm windows, the annual demand is anticipated to rise from 35 million units per year to 61.9 million units per year during the period 1980 to 1985. Based on an average cost of $15.80 per storm window, sales will increase from $555 million to $970 million.

In the market for clock thermostats, annual sales are expected to increase from $265 million to $340 million, based on an average per unit price of $56. Sales of water heater jackets could increase from $12.4 million per year to $20.4 million per year, based on a value of $.51 per pound of fiberglass insulation.

Demand for the automatic ignition device is not likely to be significantly stimulated by the RCS Program. An increase in demand of about two percent is anticipated.

(b) *Material Standards.*

(i) *Putty.* The reference program standard (F.S. TT-P-00791B) effectively prohibits the use of putty as part of the program since most manufacturers now use natural calcium carbonate in their product. However, the demand generated by the RCS Program for putty is expected to be minimal. Therefore, the economic impact of this alternative should not be significant.

(ii) *Glazing Compound.* The reference program standard (F.S. TT-G-410E) prohibits the use of several products now widely used by building contractors as window glazing compounds. The impact of this standard will be a loss of sales for those products which are not eligible as part of the RCS Program. Because the demand generated by the RCS Program for window glazing compound is likely to be relatively small, the loss of sales due to selection of this alternative is not expected to be large.

(iii) *Attic Insulation.* The reference program standard requires that the membrane covering of any insulation to be installed in an exposed attic be tested using the critical radiant flux test as described in F.S. HH-I-515D and yield a flame spread of less than 25. Kraft-faced mineral fiber batts, a product manufactured by several firms and currently in wide use, will not pass the requirements of this test if the test is conducted with the vapor barrier exposed. In this case, the material standard for insulation to be installed in exposed attics would have a major economic impact on industry.

Industry representatives estimate that more than one-third of the attics of all new homes will be insulated with kraft-faced mineral fiber batts in 1980 and the subsequent years. Although the RCS Program does not deal with new housing construction it is highly likely that those states which adopt the regulation standard for retrofit application may extend this standard to all residential attic applications. The result would be to effectively prohibit the use of kraft-faced batts in the attics of residential buildings.

Were this to occur, a product that can reasonably be expected to fill the resulting supply void is the aluminum-faced mineral fiber batt. However, this product substitution would be likely to have a negative impact on price stability in the housing construction industry. Although aluminum-faced batts will pass the requirements of the critical radiant flux test, their cost is approximately 10 percent more than that of kraft-faced batts.

The demand for kraft-faced mineral fiber batts for attics in new residential construction is estimated to be in excess of 300 million lbs. Using $.51 per pound as the cost of fiberglass in 1980, this represents a market value of $135 million. The value of the replacement product (foil backed mineral fiber batts) would be $168 million. Aluminum-faced batts can be produced on the same insulation production lines as those used for kraft-faced batts. Accordingly, there should be no change in productivity (other than that caused by the market for the higher-priced product), no major capital expenditures required and no increase in employment for the insulation manufacturers.

The foil used to make the aluminum-faced product is purchased by the insulation industry manufacturers from aluminum manufacturers. The increase in demand for aluminum foil suitable for use with insulation would burden production lines in the aluminum industry. New capital investment would be required by the aluminum industry, and a time lag of several months would result before the higher demand levels could be satisfied. This could result in an insufficient supply of insulation for new construction.

New production jobs would be created in the aluminum industry; however, it was not determined whether existing personnel would be switched from other product lines to work on foil for insulation or if additional labor would be hired.

(c) *Installation Standards.* The reference program requirements applying to the installation of loose-fill insulation in attics will affect the cost of these installations. One requirement calls for a baffle around soffit vents to prevent the insulation from clogging them. The cost of this requirement will average $0.02 per square foot of attic area more than the job done without such a measure. For a 1200 sq. ft. attic this amounts to $24.00. A second requirement calls for a barrier around recessed lighting in attics to prevent insulation from covering them. The cost of this requirement will be about $5 to $10 per recessed light. In a home with two recessed lights this would amount to a $10 to $20 increase over current practices.

A third requirement calls for the placement of wire guards around any wiring that might be covered by the loose-fill insulation. It is estimated that the cost of installing wire guards will run $.10 per sq. ft. of attic area. For a 1200 sq. ft. attic this will cost about $120 extra.

The reference program alternative also requires that minumum ventilation openings be provided as follows:

(i) With vapor barrier: 1 sq. ft. per 300 sq. ft. of attic space

(ii) Without vapor barrier:

- 1 sq. ft. per 150 sq. ft. of attic space, or
- 1 sq. ft. per 300 sq. ft. of attic space it at least 50 percent of the ventilating area is provided by fixed ventilation at least 3 ft. above the eave or soffit vents.

For the average home the cost of this requirement will be approximately the same whether or not there is a vapor barrier. The average cost for a home with 1200 sq. ft. attic space will range from $90 to $180, depending on the amount of existing ventilation in the attic. It will cost about $25 to install a paint vapor barrier as required in Zone 1 in bathrooms assuming the insulation contractor does the job.

The requirement that the installer evaluate the condition of any wiring

that might be covered by insulation is expected to have a significant impact. This is based on the opinion of a certified safety professional and underwriter with one of the larger insurance firms that it is unlikely any insurance carrier would offer liability coverage to an insulation installer who was required to conduct electrical inspections unless the installer were a licensed electrician. Therefore the services of an electrician would be required under this alternative.

The cost of having attic insulation increased from R-11 to R-30 under the requirements of the reference program alternative (excluding the vapor barrier required in Zone 1 only) have been estimated for an average home in the Washington, D.C. Such home is assumed to have 1200 sq. ft. of attic area, no attic ventilation, two recessed lights and no wire guards. The cost of a loose-fill installation under these conditions would be $830.

The cost of such an installation in the Washington, D.C. area without these requirements is $.40 per sq. ft., or $480. The requirements of the reference program standard result in a 73 percent cost increase for an average installation. A cost increase of this magnitude will reduce the competitiveness of contractors participating in the program relative to those who are not. Such a cost increase is also likely to have an inflationary effect on the buildings retrofit industry.

(d) *Replacement Furnaces.* Concern has been expressed that the RCS Program will create opportunities for aggressive energy suppliers to persuade customers of other energy suppliers to switch fuels. This concern has been particularly acute where small home heating suppliers are involved.

The proposed rule contains provisions which permit states wide latitude in establishing the requirements for home heating supplier participation in the RCS Program. Given the degree of business protection inherent in this latitude, no attempt was made to estimate the impact of the program on competition between suppliers of different types of energy.

(6) *Households.* Approximately 65.4 million households are projected to be eligible to participate in the RCS Program. For the reference program it is assumed that 7 percent of the eligible households will request an energy audit under the program each year and that 75 percent of these households will follow-up and install suggested energy conservation measures. It is assumed that the measures installed will be all those that have an average payback period of six years or less and are not already installed. The choice of six years was based upon the reported experience of a small sample of utilities that have operated residential energy conservation programs. Most of these have found that consumers are reluctant to install measures having a payback period in excess of five years.

Household investments in energy conservation measures as a result of the program will be recovered through decreased energy consumption over a period of years. The approximately $6.7 billion that will be invested in energy conservation measures will produce a gross energy cost savings to households over the useful life of the measures of $30 billion.

The RCS Program is also likely to generate increased costs for households through: (a) Increased utility rates to cover those program costs that are passed through to customers, and (b) increased state taxes to cover the costs of developing and managing the state plans.

Increases in utility rates can result from program information costs, audit costs, arranging costs and the costs of post-installation inspections. If a state regulatory authority permits all of these program costs to be passed through to a utility's customers, the average increase in a customer's utility bill will be $.25 per month during the lifetime of the RCS Program. This increase reflects only the costs of the program for conservation measures.

This average cost is likely to be higher for the customers of any of the thirty-five nonregulated utilities which are covered by the program but are not included in a state plan. Other variations in the impact of program costs on households are also likely. Some households serviced by more than one participating energy supplier will contribute to the support of more than one program. Certain households not covered by the program, such as tenants in apartment buildings with five or more units, may be required to absorb costs generated by the program without being eligible for program participation.

Some of the state costs of developing and administering the program may be recovered through increased state taxes. The average annual cost of participation in the program by all states is estimated to be $27.1 million. If all of this cost is recovered through taxation, the average increase in state taxes will be about $.28 per household per year.

The RCS Program will also result in some increases in employment which will impact a small portion of households. This employment will be generated by three sources: utilities, states, and energy conservation measures, manufacturers and installers.

b. *Energy impacts*

(1) *Energy Consumption.* Under the reference program household energy use will decrease by approximately 0.38 Quad annually by 1985 as a result of the energy conservation measures installed under the RCS Program. This represents 2.2 percent of projected residential energy consumption by 1985, or 0.2 MBD (oil-equivalent).

(2) *Household Response to the Utility Program.* The demand for audits will fall rapidly as the price charged for audit increases from zero. With an audit provided free of charge to residential customers, the highest empirical rate experienced by a utility whose program approximated the RCS Program was an annual response rate of about seven percent. A group of utilities which conducted programs that were also similar to the RCS Program found that higher direct charges resulted in lower response rates. For energy audit charges of about $12.00, the annual response rate was only 1.5 percent. One utility which charged $25 for an energy audit has received an annual response rate of less than 0.25 percent. These experiences indicate that the price of the audit will have a significant effect on the response rate to the program. To the extent that providing energy audits induces households to purchase conservation measures, the impact of the program on energy savings may be signficantly impacted by the cost of the audit.

3. Impact Estimation of Alternatives for the Required Scope of the RCS Program Audit

a. *Economic impact*

(1) *Utilities.* The reference program includes three separate audits, one for energy conservation measures, one for solar water heating, and one for other renewable resources measures. One of the alternatives to the reference audit package is to require one comprehensive audit which covers all energy conservation and renewable measures. If the demand for all three of the audits in the reference program package remained unchanged, this alternative could reduce the total cost to covered utilities of administering the audit program. Fewer trips would be required, and the total time for all three audits would be less.

Where the audit costs are charged directly to the homeowner, the total demand for audits is likely to decline because of the additional cost of the renewable resource audits. Utility costs would then decline in proportion to the lower response. Where all audit costs are expended, however, this in not likely. The demand for energy conservation audits will not be reduced by the added costs of the renewable resource audits because these added costs will not be charged to the customer requesting an audit. The one comprehensive audit will still require two auditors, one trained in conserva-

tion measures and one in renewable resource measures; therefore, the cost to the utility (and, ultimately, all the utility's customers) will rise.

The other alternative to the reference program package of three separate audits is to require that two separate audits be offered: A combined audit covering conservation measures and solar water heating, and a second audit for all other renewable resources, to be available after and contingent upon the results of the first audit. This alternative is likely to reduce the overall cost to the utility; adding solar water heating to the conservation measures audit adds only about one-half hour to the total audit time and eliminates one trip. A net one hour is saved by combining the conservation measures and solar water heating audit. This assumes that one auditor will conduct the combined audit for conservation measure and solar water heating.

(2) *Households.* If a major portion of the audit is charged to the customer requesting it, a large part of the cost shifts from all utility customers to those customers. Regarding the alternative calling for a single comprehensive audit package, the utilities' savings in costs relative to three separate audits would be passed on to those customers requesting all three audits. The total audit time would be reduced from 7½ hours to 5 hours and the cost from about $190 to $125, a savings of $65 per audit.

However, when a major portion of these costs are charged directly to the customer, only customers interested in the renewable resource audit are likely to incur the cost. In this situation, the benefits of the program from this alternative are likely to be redistributed from customers who have an interest primarily in energy conservation measures to those who have a preference for renewable resource measures.

Regarding the alternative calling for two separate audits and direct charging, the cost savings for all three audits is not as great. The cost of the total package is reduced from $190 to $160. This alternative presents less of a disincentive to homeowners who are interested only in the energy conservation audit; however, the additional cost for the solar water heater will deter some customers that otherwise would request the energy conservation audit. Therefore, there will be redistribution of consumer benefits to those interested in renewable resources, although it will be less of a redistribution than would occur with the preceding alternative.

*b. Energy impact*

(1) *National and Households.* For both alternatives, in the case where the audits are fully expensed, the energy savings will increase. There will be some customers who, in the absence of a required renewable resources audit, would not have been exposed to the benefits of renewable resource measures and therefore would not have considered installing them. Renewable resource installations by these customers will provide added energy savings.

In the case where a major portion of the audit cost is charged directly to the customer, the demand for the single comprehensive audit should be greatly reduced relative to the demand for separate audits. This will reduce the number of households participating and therefore reduce the program benefits from decreased energy consumption.

Separately charging the costs of the combined energy conservation and solar water heater audit and the other renewable resource audit will also reduce the energy savings benefits, although not as much. The energy savings from the small increase in households installing solar water heaters will partly compensate for the reduction in those installing any measures; however, this is not expected to be a major offsetting factor. An intangible benefit leading to greater future energy savings is the added exposure solar systems receive nationwide through the added solar water heater installations.

4. Impact Estimation of Alternatives for the Required Scope of the Energy Conservation Measures Audit

*a. Economic impact*

(1) *National.* The aggregate costs of the RCS Program increase as the required content of the conservation measures audit is expanded to include more than only those measures that pay for themselves within six years (the reference program audit content). Of the two additional alternatives proposed for the prescribed content of the conservation measures audit, one would include in the audit each energy conservation measure that pays for itself within its useful life. This alternative requires an additional 2,200 auditors each year and increases the total cost of the reference program by $405 million.

The second alternative would include in the audit all energy conservation measures which are listed in the legislation. This alternative requires an additional 5,200 auditors nationwide each year at an increased total program cost of $973 million.

(2) *Utilities.* The cost to a covered utility of average size increases as the required content of the conservation measures audit is increased to include more than only those measures that pay for themselves within six years (the reference program audit content). Increasing the required content of the audit to include each energy conservation measure that pays for itself within its useful life would increase the audit time from 2 to 2½ hours. For a utility of average size this additonal half hour would require from three to seven more auditors each year depending upon the utility's previous level of activity in a residential energy conservation program. The increase in costs to the utility for the five years of the program would range from $0.6 million to $1.3 million.

Increasing the required content of the audit to include all energy conservation measures which are listed in the legislation, would require an additional 15 auditors per utility each year. The costs to a covered utility of average size would increase by $2.8 million over the reference program costs.

(3) *Home Heating Suppliers.* The cost per average home heating supplier increases as the content of the conservation measures audit is expanded to include more than only those measures that pay for themselves within six years (the reference progam audit content). The alternative which increases the number of measures to each energy conservation measure that pays for itself within its useful life would increase the time required to audit a residence from 2 to 2½ hours. For the average fuel dealer this would require an additional two hours per week conducting audits. The increase in costs to the dealer for the five years of the program would be about $9,500.

The alternative which includes in the audit all energy conservation measures which are listed in the legislation would require an additional four hours per week per dealer. The additional cost to the home heating supplier of this alternative over that of the reference program would be about $18,500 during the five years of the program.

(4) *Households.* Including each measure which pays for itself within its useful life in the audit and expensing the full audit cost would increase the cost passed on to all customers of a covered utility by less than $0.06 per month. An audit which includes all energy conservation measures listed in the legislation would increase the cost passed on to all utility customers by about $0.14 per month.

*b. Energy impact*

(1) *National.* Previous experiences of utilities with audit programs indicate that homeowners are reluctant to purchase any conservation measure which has a payback period of more than six years. Therefore, the benefits in energy savings from increasing the re-

quired contents of the conservation measures audit for either alternative are likely to be minimal.

5. Impact Estimation of Alternatives for the Required Scope and Duration of the Post-Installation Inspections

*a. Economic impact*

(1) *National.* The reference program includes a requirement for post-installation inspection of all vent damper and intermittent ignition device installations and twenty percent of any other measures installed. One of the alternatives to this requirement is to eliminate the requirement altogether. This would reduce aggregate costs of covered utility and home heating supplier participation by $120 million. The total program costs over the five years would decline from $2 billion to $1.9 billion. Aggregate employment would be affected by the elimination of the 500 full-time positions for post-installation inspectors.

The second alternative to the reference program requires that every program installation be inspected. This requirement would increase aggregate costs of covered utility and home heating supplier participation by approximately $354 million; the total costs over the five years of the program would rise from $2 billion to $2.4 billion. Employment for post-installation inspectors would increase from 500 to 2,000 nationwide.

Any alternative which reduces the period of time over which post-installation inspections are required will also reduce the cost of these inspections and, therefore, the program. The maximum reduction would yield cost savings identical to those for the first alternative above, i.e., identical to the situation in which there are no inspections or cost savings of $120 million.

(2) *Utilities.* Eliminating the reference program requirement for post-installation inspections, as in the first alternative, would reduce the five-year cost of the RCS Program for a covered utility of average size by $350,000. The average five-year cost of the program for such a utility would decline from the reference program estimate of $5.3 million to $4.9 million. About 1½ full-time equivalent inspector positions would be eliminated for each covered utility.

The second alternative, which expands post-installation inspections to include every program installation, would increase the average five-year cost for a covered utility of average size by about $1 million. The total program cost for five years for such a utility would rise from an average of $5.3 million to nearly $6.4 million. Under this alternative, a utility of average size would require about six inspectors or an increase of about 4½ full-time-equivalent positions over the reference program requirement.

(3) *Home Heating Suppliers.* Eliminating the reference program requirement for post-installation inspections, as in the first alternative, would reduce the five-year costs of the program for an average home heating supplier by about $2,000, from $40,000 to $38,000. The corresponding reduction in employment is negligible since the typical fuel dealer requires inspection capabilities on an occasional basis.

The second alternative, which requires that all program installations be inspected, would increase the cost of the program to an average home heating supplier by about $5,500 over the five years of program operation. The total program cost to a dealer would therefore rise from $40,000 to about $45,000. The corresponding increase in employment for the average fuel dealer is insignificant; the number of inspections required would increase from 11 to 57 per year. Less than four additional man-hours per week would be sufficient to cover this increase in inspections.

(4) *Households.* Eliminating post-installation inspections would reduce the reference program cost passed on to all customers of a utility by about $0.01 per month. At the same time, the benefits of ensuring quality workmanship would be reduced. The second alternative, to inspect all program installations, would increase the cost passed on to all customers of a utility by about $0.05 per month.

*b. Energy impact*

(1) *National.* Eliminating the requirement for post-installation inspections, as in the first alternative to the reference program, might reduce the demand for services through the RCS Program because the benefit incentives available to the consumer will be correspondingly reduced. To the extent that this reduced demand for program services also reduces the demand for measures, the energy savings achievable by the program will be reduced.

Conversely, the alternative requirement that every installation under the program be inspected will make the benefit package more attractive to some households and increase the household participation rate. To the extent that this increase in participation results in an increase in the purchase of measures, a corresponding increase in energy savings would result.

Any alternative which reduces the period of time over which post-installation inspections are required will also reduce the corresponding consumer benefits of participation in the program. To the extent that homeowners choose not to install measures as a result of this reduction in benefits, a reduction in energy savings will occur.

6. Impact Estimation of Alternatives for the Required Scope of the Qualification for Energy Auditors

*a. Economic impact*

Of the three alternative auditor qualification requirements proposed, the reference program utilized the alternative requiring state training in conformance with DOE requirements. The second alternative proposes that there be no requirement for specialized training of auditors. The third requires that the scope of the specialized training be determined by the states.

(1) *National.* The total cost of auditor training, assuming all states participate, of the reference program alternative for the years 1979 through 1984 is estimated to be $6 million for plans covering regulated utilities and $7 million for plans covering both regulated utilities and home heating suppliers. There is no cost to states under the second alternative. For the third alternative, the total costs are estimated to be $4 million for both types of plan coverage.

(2) *States.* Total training costs were estimated for the period 1979 to 1984 for each of the options available to the states regarding the content and coverage of their Residential Energy Conservation Plans. For the purpose of comparing the alternatives, these costs were disaggregated from the total cost reported under the reference program discussion.

For the reference program alternative, the training costs per state will range from $54,000 for a small state using the least expensive combination of program options to $285,000 for a large state using the most exensive combination of plan options. Eliminating the training requirement, as in alternative two, would eliminate all training costs for the states.

Alternative three permits each state to establish its own training requirement. The estimated training costs per state for this alternative range from $27,000 to $125,000. This represents a decrease in cost from the reference program alternative of 50 percent or more for each state.

It is assumed that any state auditor qualification program will be a contract item since the RCS Progam is temporary and state civil service commissions are not likely to be experienced in the area of job qualification evaluation required for the program. Therefore, these activities will not affect the number of state jobs.

(3) *Households.* Households will absorb additional costs of state program administration through either increased taxation levels, or decreases in other state services. Per capita cost figures provide an indication of the

level of this impact. The five-year cost of DOE-established training requirements ranges from $0.03 to $0.04 per capita.

There is no cost for the second alternative where training is not required. State training requirements will result in a five-year per capita cost ranging from $0.01 to $0.02. This is a decline of 50 percent or more from the per capita cost of training requirements as established by DOE.

7. Impact Estimation of Alternatives for the Required Scope of Installation Standards for Loose-Fill Insulation

*a. Economic impact*

(1) *Households.* The first alternative to the reference program standard specifies that all of the proposed loose-fill installation requirements except the requirements for a wire guard and wiring inspection be specified for program installations. The elimination of these requirements will reduce the cost of a reference program attic retrofit by $120, or 14 percent. These estimates were made for an average home in the Washington, D.C. area assumed to have R-11 in the attic, no attic ventilation, 1200 square feet of attic area and two recessed lights. The assumed program installation consists of increasing the insulation value to R-30 with blown loose-fill insulation.

The second alternative to the reference program standard is the same as the first alternative with the addition of a requirement that loose-fill insulation not be installed higher than the level of any wires crossing the tops of exposed ceiling joists. The economic effect of this alternative on households is approximately the same as that of the first alternative.

(2) *Industry.* Elimination of the wire guard and wiring inspection requirements will reduce the competitive disadvantage of insulation contractors who have to charge for the extra wire guard installation and wiring inspection.

The second alternative to the reference program would limit the height to which loose-fill insulation may be installed in order to avoid surrounding attic wiring with insulation. This height limitation places a restriction on the types of loose-fill insulation which are likely to be cost-effective. For example, for the same depth of insulation, loose-fill cellulose has a much higher insulating value than does fiberglass. this will tend to make the types of loose-fill insulation that have a higher R-value per inch of depth more attractive. Since cellulose has the highest R-value per inch relative to the other types of loose-fill insulation commonly used, this alternative will tend to bias the loose-fill market toward cellulose insulation.

Additionally, this height limitation will reduce the amount of loose-fill insulation that can be installed under the program. This may constitute a disincentive to insulation contractors to participate in the RCS Program.

8. Impact Estimation of Alternatives for the Required Material Standard for Putty

*a. Economic impact.*

(1) *Industry.* The two alternatives to the reference program standard are to permit the use of commercially available products and to use a modified version of the existing GSA standard that would allow the use of natural calcium carbonate in place of precipitated calcium carbonate.

The alternative allowing commercially available products to be used will eliminate the very small loss of putty sales expected from the reference program putty standard.

The second alternative to the reference program putty standard permits the use of putty products that are currently in use the building industry. Adoption of this standard will reduce the already small sales loss due to the standard used in the reference program to a negligible impact.

9. Impact Estimation of Alternatives for the Required Material Standard for Glazing Compound

*a. Economic impact*

(1) *Industry.* The one alternative to the reference program standard allows commercially available glazing compounds to be used. This alternative eliminates the already minor economic impact of the reference program standard.

10. Impact Estimation of Alternatives for the Required Material Standard for Attic Insulation

*a. Economic impact*

(1) *Industry.* The alternative to the reference program requirement of a critical radiant flux test substitutes a requirement that attic insulation carry a fire hazard warning label. Because industry currently complies with this requirement, selection of this standard will eliminate the 10 percent increase in costs and other impacts relative to existing practice that are projected for the reference program standard.

## C. ECONOMIC IMPACT OF THE RENEWABLE RESOURCES COMPONENT OF THE RESIDENTIAL CONSERVATION SERVICE PROGRAM

### 1. Background

An assessment was performed of the macroeconomic impacts on the U.S. economy of the solar, including wind (renewable resource), portion of the Residential Conservation Service Program, viewed as one component of the overall national solar program in the period 1980–1985. Tax credits are a complementary component of the national program.

DOE had previously published estimates of solar systems penetrations and energy displacement impacts for the combined national solar program. This was done in preparation for the Domestic Policy Review of solar energy. These DOE estimates for the Domestic Policy Review provided the basis for this economic impact assessment.

Consistent with the established DOE solar penetration estimates, only the dominant active domestic solar systems were addressed rigorously in this macroeconomic impact assessment: hot water; hot water and space heating; and a heat pump primarily for cooling and secondarily for space heating. Consistent with the DOE report for the Domestic Policy Review, passive heating and cooling systems and wind systems were not addressed rigorously; their potential impacts are expected to be small compared to the active solar measures, and were assessed in a heuristic manner.

### 2. Method of Assessment

National level economic impacts were assessed using the Department of Energy data concerning solar systems penetrations and the Department of Labor standard economic assessment methods. Because the national-level impacts were found to be relatively small, they were not analyzed further to assign them to specific regions of the country.

As noted, investments in residential solar systems and corresponding savings in energy demand have been estimated by DOE for 1985. These DOE established penetration estimates were used to compute changes in the levels of final demands for specific industrial sectors, on a national level, for the Bureau of Labor Statistics (BLS) economic input/output (I/O) model forecasts for 1985. This involved determining the economic content, by industrial sector, of the projected solar system sales and relating this economic activity to that projected previously by the BLS without consideration of the solar program.

The BLS I/O model was solved with the projected changes due to solar system sales, to estimate changes from the base case in national production and employment by industrial sector.

### 3. Overview of Findings

For the period 1976–1985, per DOE established penetration estimates, approximately 1,462,000 conventional

systems are estimated to be displaced (i.e., retrofit applications) by active solar systems, for cumulative equivalent electricity demand savings in 1985 of approximately 0.03 Quads. Use of the BLS I/O model produced estimates of a relatively small but distinctly positive impact on the national economy due to this composite national solar thrust, of which the Residential Conservation Service Program is an integral component: Total production is estimated to increase by 975–1,241 million 1963 dollars; and total employment is estimated to increase by 38–45 thousands jobs, with a modest decrease of about 1,000 jobs in the electric utilities sector.

Estimated on an aggregated national level, this production increase is on the order of 0.03 percent of Total Value Added in Manufacturing. The associated increase in total employment is on the order of 0.04 percent. Since these impacts are modest, relative to the overall economy and work force, regional allocations of the impacts were not developed.

Highlights of the sectorial changes due to the increased employment anticipated are an increase of around 21,000 jobs in the residential building construction sector and an increase of around 2,300 jobs in the heating apparatus and plumbing fixtures sector.

Without performing additional detailed analysis using the I/O model, it is difficult to quantify the potential impacts of those systems omitted from the rigorous assessment, i.e., passive and wind systems. This is especially true with regard to the inter-industry trade-offs. However, a first estimate is that the impacts will be in the same direction as those analyzed, and at the aggregate level they can be estimated by scaling the impacts from those systems addressed, based on the relative energy savings. Such scaling results in a first-order estimate of 8 to 9 thousand additional total jobs, with an additional decrease of about 200 jobs in the electric utilities sector. Again, the projected changes in the economy are positive, but modest.

### D. REASONS FOR SELECTING THE PREFERRED ALTERNATIVES

#### 1. The Required Scope of the RCS Program Audit

DOE proposes to require that the program audit consist of two parts. Each household must be offered two separate audits: One addressing energy conservation measures and the other covering renewable resource measures. Households interested in solar hot water heater audits will be able to request them in connection with the energy conservation measures audit as well as with the renewable resource measures audit. This choice is a combination of alternatives (1) and (3)

DOE has two principal reasons for selecting this alternative. First, DOE believes that all suggested conservation measures, such as insulation and furnace improvements, must be considered by households in one audit in order to encourge investment in the most effective measures. Second, the audit alternative consisting of one comprehensive audit covering energy conservation and renewable resource measures was thought to be less effective in encourgaing household interest in the audit. The cost of a comprehenive audit is likely to be significantly higher than that of the energy conservation measures audit alone. Analysis of some of the existing, limited experience with energy audit costs indicates that public response to the offer of an audit declines rapidly as its cost increases. Additional energy savings might be realized by those households that request the comprehensive audit and actually install renewable resource measures. However, these additional savings are not likely to offset the energy savings possibly lost because fewer households request the higher-cost audit.

Addition of the solar hot water heater audit as an optional item with the energy conservation audit does not necessarily increase the cost of the energy audit to an extent that public response will seriously decline. Solar hot water heaters are increasingly popular devices. Their inclusion as an option with the energy conservation audit is thought to increase the likelihood that they will be installed, yet have little detrimental effect on the response to the energy conservation audit.

#### 2. The Required Scope of the Energy Conservation Measures Audit

DOE proposes to require that the energy conservation audit cover each energy conservation measure that is likely to pay for itself within its useful life. This alternative will increase the cost of the RCS Program to states and utilities by $405 million.

Given the present household reluctance to invest in measures with a payback period in excess of five years, however, this increase in costs is not likely to yield a corresponding increase in energy savings. However, the alternative which specifies a lower-cost six-year payback period exludes several worthwhile measures without any economically valid reason other than household reluctance to invest for a longer period. Requiring an audit of each measure that will pay for itself within its useful life might encourage households to consider energy conservation measures that eventually will return an energy savings even if it is not within six years. In view of the RCS Program goals, this choice of the energy conservation audit content appears reasonable.

DOE invites officials of state governments and representatives of covered utitilies and the audit industry to comment on this requirement.

#### 3. The Required Scope and Duration of the Post-Installation Inspection

DOE proposes to require that there be mandatory inspections of all installations of vent dampers, intermittent ignition systems and wind energy systems, and that there be random inspection of the installation of all other measures. The random inspections will cover:

(a) Four of the first ten installations under the program by each insulation contractor; and

(b) Twenty percent of the installations of each suggested measure done under the program, excluding those measures covered under the mandatory inspection requirements, but including installation of insulation materials.

The mandatory inspection provisions reflect DOE's recongition that the quality of the installation of vent dampers, intermittent ignition systems and wind energy systems is critical to the safety of the occupants of buildings so equipped. The requirement for random inspection of all other installations is considered necessary to ensure that contractors install measures in accordance with the installation standards of the program.

DOE does not evision its inspection program as a punitive measure, but rather as a means of promoting safe and effective installation of measures. Therefore, DOE proposes to give each state the option to reduce the twenty percent random inspection requirement provided that the state can demonstrate to DOE that the random inspections are no longer necessary to ensure safe and effectice installation of suggested measures under the program.

#### 4. The Required Scope of the Qualification for Energy Auditors

DOE proposes to require that knowledge of certain basic concepts be demonstrated in order for individuals to qualify as energy auditors. The states may determine the qualification method used to demonstrate this knowledge. This choice is equivalent to alternative (3) for this provision.

Minimum knowledge requirements include:

(a) Understanding of the national energy situation,

(b) Familiarity with residential construction,

(c) Familiarity with the measures suggested for the state in which the auditor will be working,

(d) Familiarity with energy conserving practices, and

(e) Proficiency in energy audit procedures.

With this alternative, DOE has attempted to strike a balance between the particular needs of each state and the goals of the RCS Program. On the one hand, it gives states maximum flexibility in tailoring the auditor qualification requirements to the unique conditions that exist in each state. On the other hand, establishment of a minimum knowledge requirement is intended to ensure that the auditors possess the basic skills necessary to conduct effective audits. The auditor is the first point of personal contact with the household; therefore, his or her competence in both the technical and personal aspects of the audit are crucial to the success of the program.

5. The Required Scope of Installation Standard for Loose-Fill Insulation

DOE proposes to specify as minimum requirements for an installation of loose-fill insulation those requirements listed in alternatives (1) and (3) for this provision. These requirements call for the use of:

(a) Soffit vent baffles,

(b) Barriers around recessed lights,

(c) Minimum ventilation in attics,

(d) Vapor barrier on ceilings and walls in attics and bathrooms in Zone 1 only,

(e) Inspection for moisture damage,

(f) Inspection of the condition of attic wiring, and either

(g) Wire guards, or

(h) A restriction that all loose-fill insulation be below the level of any wiring.

The choice of this alternative reflects DOE's view that trade-offs must be made between safety, effectiveness, and cost. DOE recognizes that these requirements will result in a significant increase in the cost of a loose-fill installation. The Regulatory Analysis indicates that for a home in the Washington, D.C. area having certain assumed characteristics, the requirements could increase the cost of installing loose-fill insulation by seventy-three percent.

DOE is also sensitive, however, to the long-term problems that can arise from the use of loose-fill insulation without the precautions required by this standard. These problems were given heavy weight in making the trade-offs among cost, safety, and effectiveness.

DOE is not convinced at this time that the standard as proposed is necessarily the most acceptable form of this trade-off. A large share of the added costs is due to the requirements regarding wiring. DOE, the National Bureau of Standards, the Consumer Products Safety Commission, and the Community Service Administration are all embarking on research or demonstration projects which will help to deal with the concerns raised when insulation is installed in the vicinity of wiring. These projects include:

(a) Laboratory studies on encapsulated wiring to determine the temperatures of encapsulated wiring under various loading conditions;

(b) Field studies in cooperation with various utilities to determine wiring temperatures reached and length of time the temperatures are sustained in actual homes;

(c) Field study of low-income homes to evaluate the condition of attic wiring;

(d) Hot-line with fire marshalls to investigate causes and origins of electrical fires.

The timing of the research and regulations is such that final rules will not be issued until research results are available. Based on these results, DOE is hopeful that the wiring requirements can be relaxed in the final rules. Public comment is encouraged on this and other approaches to the cost, safety, and effectiveness tradeoffs involved.

6. The Required Material Standard for Putty

DOE proposes to require the use of the GSA standard F.S. TT-P-00791B modified to allow the use of natural calcium carbonate instead of precipitated calcium carbonate. The alternative requirement that putty products be made with precipitated calcium carbonate totally precludes the use of existing putty products under the program. This restriction is considered unnecessarily stringent.

7. The Required Material Standard for Glazing Compound

DOE proposes to permit the use of any commercially available glazing compound product for installations under the program. Glazing compound is not expected to be used often in connection with program installations, and no reason was found to require a more restrictive standard.

8. The Required Material Standard for Attic Insulation

DOE proposes to require both of the proposed alternatives in its standard for attic insulation materials. The NBS-developed critical radiant flux test and smoldering combustion test are considered necessary to ensure the fire safety of these materials. The fire hazard labelling requirement is considered necessary to encourage proper installation by those who install the insulation themselves.

Questions were raised during the discussion of the critical radiant flux test concerning the adequacy of the test procedure for evaluating the fire safety of kraft-faced insulation. This paper membrane is flammable and will not pass the critical radiant flux test unless specially treated. The test procedure, however, requires that the draft paper vapor barrier be placed face down in a tray and away from the open flame. This requirement duplicates the position of insulation properly installed in an attic and the test therefore evaluates the fire danger of the insulation when properly installed. Most if not all of the kraft insulation now used will pass the test when it is carried out in this manner. However, if the attic insulation is installed improperly with the draft paper vapor barrier face up, a definite fire hazard may be created which the test, as prescribed, cannot assess. Therefore, its adequacy was questioned.

Testing the insulation with the kraft-faced vapor barrier up was considered as a solution. Serious questions were raised, however, as to the validity of testing a product in an improperly installed application. Additionally, since there is a lack of data on the incidence of such improper installations and their contribution to the spread to fire in attics, there is a question concerning the need for such a test. The test, therefore, was adopted as prescribed with the additional requirement of the fire hazard warning label. This label will alert the consumer to the fire hazard resulting from improper installation. Public comment on this choice is invited, and any information on incidents in which flame spread might have been related to the kraft membrane is solicited.

## XII. Environmental and Urban Impact Analysis

In accordance with the requirements of the National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. 4321 *et seq.*, DOE is undertaking an environmental assessment of the Residential Conservation Service Program. NECPA requires DOE to issue a proposed rule 60 days following the Advance Notice of Proposed Rulemaking. Consequently, DOE is unable to complete an environmental assessment to accompany this Notice of Proposed Rulemaking. This assessment and any additional NEPA review will be completed prior to the promulgation of the final rulemaking.

This Proposed Rule has been reviewed in accordance with OMB Circular A-116 to assess the impacts on urban centers and communities. DOE has determined that the Proposed Rule is a major policy and program

initiative which requires formal urban and community impact analysis. The analysis will be incorporated into the regulatory analysis required under Executive Order 12044.

## XIII. Consulation With Other Federal Agencies

In preparing this Proposed Rule, issues and options were reviewed by representatives of the Secretary of Housing and Urban Development, Federal Trade Commission, Consumer Product Safety Commission, National Bureau of Standards, and the General Services Administration.

A copy of this notice was submitted to the Administrator of the Environmental Protection Agency (EPA) for comments concerning the impact of this proposal on the quality of the environment. The Administrator had no comments.

## XIV. Comment and Hearing Procedures

### A. Written Comments

Interested persons are invited to participate in this rulemaking by submitting data, views, or arguments with respect to the proposed procedures, requirements, and criteria. Comments should be submitted to the address indicated in the addresses section of this preamble and should be identified on the envelope and on the documents submitted to DOE with the designation "Residential Conservation Service," (Docket No. CAS-RM-79-101). Fifteen copies should be submitted. All written comments must be received by May 25, 1979, 4:30 p.m., e.d.t., to insure consideration.

The Federal Trade Commission (FTC) staff has specifically requested that the FTC be allowed an additional three weeks to submit their written comments. The reason for this request is that the FTC staff wishes to review and consider the public comments in drafting their comments with respect to competition and protecting against unfair and deceptive practices. DOE considers this a reasonable request, and, because other agencies such as the Consumer Product Safety Commission and the Environmental Protection Agency might also wish to avail themselves of this opportunity, DOE will specifically extend the written comment period for Federal agencies so requesting until June 15. These comments will be available to the public as indicated below.

All written comments received after publication of these proposed rules, whether or not submitted in accordance with these procedures, and all written comments received pursuant to the Advance Notice of Proposed Rulemaking (44 Fed. Reg. 2158, January 9, 1979), will be available for public inspection in the DOE Reading Room, Room GA-152, Forrestal Building, 1000 Independence Avenue, SW., Washington, D.C., between the hours of 8:00 a.m. and 4:30 p.m., Monday through Friday. Any information or data considered by the person furnishing it to be confidential must be so identified and submitted in writing, one copy only. DOE reserves the right to determine the confidential status of the information or data and treat it according to its determination.

### B. Hearing Procedures

The time and place of the public hearings are indicated in the dates and addresses section of this preamble. DOE invites any person who has an interest in the proposed rulemaking, or who is a representative of a group or class of persons that has an interest in the proposed rulemaking, to make a written request for an opportunity to make an oral presentation. Such a request should be directed to the address indicated in the addresses section of this preamble and must be received before 4:30 p.m. on:

March 22 for Philadelphia Hearing
March 29 for New Orleans Hearing
April 5 for Boston Hearing
April 12 for Washington, D.C. Hearing
April 19 for St. Louis Hearing
April 26 for San Diego Hearing
May 3 for Salt Lake City Hearing

Such a request may be hand delivered to Room 2221C, 20 Massachusetts Avenue, NW., between the hours of 8:00 and 4:30 p.m., Monday through Friday. A request should be labeled both on the document and on the envelope "Residential Conservation Service Program."

The person making the request should briefly describe the interest concerned; if appropriate, state why she or he is a proper representative of a group or class of persons that has an interest; give a concise summary of the proposed oral presentation; and provide a telephone number where he of she may be contacted through the day of the hearing.

Each person who, in DOE's judgment, proposes to present relevant material and information shall be selected to be heard and shall be notified by DOE of his or her participation before 4:30 p.m. on:

March 26 for Philadelphia Hearing
April 2 for New Orleans Hearing
April 9 for Boston Hearing
April 16 for Washington, D.C. Hearing
April 23 for St. Louis Hearing
April 30 for San Diego Hearing
May 7 for Salt Lake City Hearing

Each person selected to appear at the hearing must bring 15 copies of her or his statement to the hearing at the address given to the addresses section of this preamble.

The hearings will be held beginning at 9:00 a.m., local time.

### C. Conduct of Hearings

DOE reserves the right to arrange the schedule of presentations to be heard and to establish the procedures governing the conduct of the hearing. The length of each presentation may be limited, based on the number of persons requesting to be heard.

A DOE official will be designated as presiding officer to chair the hearing. Questions may be asked only by those conducting the hearing, and there will be no cross-examination of persons presenting statements.

Any participant who wishes to ask a question at the hearing may submit the question, in writing, to the presiding officer. The presiding officer will determine whether the question is relevant and material, and whether the time limitations permit it to be presented for answer.

Any further procedural rules needed for the proper conduct of the hearing will be announced by the presiding officer.

A transcript of the hearing will be made and the entire record of the hearing, including the transcript, will be retained by DOE and made available for inspection at the DOE Freedom of Information Reading Room, Room GA-152, Forrestal Building, 1000 Independence Avenue SW., Washington, D.C. 20585, between the hours of 8:00 a.m. and 4:30 p.m., Monday through Friday. Any person may purchase a copy of the transcript from the reporter.

### D. Question and Answer Sessions

Given the length and complexity of the Proposed Rule and in order to facilitate comments on the rules, DOE is prepared to arrange in Washington a limited number of question and answer sessions for interested persons and representatives of interested organizations in the two weeks following publication of the Proposed Rule. These sessions will not be used for soliciting or receiving comments on the rules. Rather they will be limited to DOE personnel answering questions on what the Proposed Rule provides and does not provide. Persons interested in attending such sessions should contact James R. Tanck, Director, Residential Conservation Service, (202) 376-4708, for exact dates, times, and places of the sessions. These sessions will be tape recorded, and the recordings will be available in the DOE Reading Room, Room GA-152, Forrestal Building, 1000 Independence Avenue SW., Washington, D.C., between the hours of 8:00 a.m. and 4:30 p.m., Monday through Friday.

In consideration of the foregoing, the Department of Energy proposes to amend Chapter II, Title 10 of the Code of Federal Regulations, by adding a new Part 456 as set forth below.

Issued in Washington, D.C., on March 12, 1979.

OMI WALDEN,
*Assistant Secretary, Conservation and Solar Applications.*

10 CFR Part 456 is amended by deleting § 456.00 and establishing new Subparts A, B, C, D, E, F, G, H, I as follows:

**Subpart A—General Provisions and Definitions**

Sec.
456.101 Purpose and Scope.
456.102 Petitions Concerning Conflicts of Laws.
456.103 Appeals.
456.104 List of Covered Utilities.
456.105 Definitions.

**Subpart B—Preparation, Submission, and Approval of State Plans and Temporary Programs**

456.201 Scope.
456.202 Initial Submission.
456.203 Coordination Requirements.
456.204 Notice, Comment, and Public Hearing.
456.205 Procedures for Submission and Approval of State Plans.
456.206 Home Heating Suppliers.
456.207 Tennessee Valley Authority (TVA).
456.208 Temporary Programs.

**Subpart C—Content of State Plans**

456.301 Scope.
456.302 Coverage of State Plan.
456.303 Procedures for Investigating and Enforcing Compliance with the State Plan.
456.304 Exemptions and Waivers for Utility Supply, Installation, and Financing.
456.305 Scope of Benefits.
456.306 Program Announcement.
456.307 Requirements for Energy Audits.
456.308 Arranging Installation.
456.309 Arranging Financing.
456.310 Accounting and Payment of Costs.
456.311 Billing of Costs, Repayment of Loans, and Termination of Service.
456.312 List of Suppliers, Contractors, and Lenders.
456.313 Post-Installation Inspection.
456.314 Qualification Procedures for Auditors, Installers, and Inspectors.
456.315 Complaints Processing Procedures.
456.316 Coordination.
456.317 Home Heating Suppliers.
456.318 Reporting and Recordkeeping.

**Subpart D—Nonregulated Utility Plans**

456.401 Scope.
456.402 Coverage.
456.403 Initial Submission.
456.404 Coordination Requirements.
456.405 Notice, Comment, and Public Hearing.
456.406 Procedures for Submission and Approval of Nonregulated Utility Plans.
456.407 Temporary Programs.
456.408 Content of Plans.

**Subpart E—Supply, Installation, and Financing by Utilities**

456.501 Scope and Definitions.
456.502 Prohibition.
456.503 Exception for Certain Measures and Small Loans.
456.504 Exception for Existing Supply, Installation, and Financing.
456.505 Waivers.
456.506 Exception for Supply, Installation, and Financing Authorized by State Law.
456.507 Procedure for Obtaining Determinations and Waivers.

**Subpart F—Federal Standby Authority and Enforcement Provisions**

456.601 Scope.
456.602 Conditions Under Which Standby Authority Shall be Invoked.
456.603 Standby Authority in Lieu of State Plans.
456.604 Standby Authority for Nonregulated Utilities.
456.605 Failure to Comply With Orders.
456.606 Enforcement Provisions.

**Subpart G—Renewable Resource Installation and Material Standards**

456.701 Scope.
456.702 Solar Domestic Hot Water and Active Solar Space Heating Systems.
456.703 Thermosiphon Hot Water Heaters. [Reserved]
456.704 Passive Solar Space Heating and Cooling Systems. [Reserved]
456.705 Swimming Pool Heaters. [Reserved]
456.706 Wind Systems.

**Subpart H—Energy Conservation Material Standards**

456.801 Purpose and Applicability.
456.802 Definitions.
456.803 Standards for Loose-Fill Cellulosic or Wood Fiber Insulation.
456.804 Standards for Loose-Fill Mineral Fiber Insulations.
456.805 Standards for Mineral Fiber Blanket and Batt Thermal Insulation.
456.806 Standards for Vermiculite Thermal Insulation.
456.807 Standards for perlite Thermal Insulation.
456.808 Standards for Polystyrene Thermal Insulation Board.
456.809 Standards for Polyurethane and Polyisocyanurate Thermal Insulation Board.
456.810 Interim Standards for Urea-Formaldehyde Based Foam Insulation.
456.811 Standards for Aluminum Foil Reflective Thermal Insulation.
456.812 Standards for Storm Windows, Storm and Thermal Doors, Caulks and Sealants, Clock Thermostats, Water Heater and Heating/Air Conditioning Duct Insulation.
456.813 Standards for Aspects of Multiglazed Insulating Glass Units for Windows and Doors.
456.814 Standards for Furnace Efficiency Modifications.
456.815 Load Management Devices.

**Subpart I—Energy Conservation Installation Standards**

456.901 Scope.
456.902 Definitions.
456.903 Coverage and Additional Requirements.
456.904 Standard Practice for the Installation of Organic and Mineral Fiber Loose-Fill Thermal Insulation.
456.905 Standard Practice for the Installation of Mineral Fiber Batts and Blankets Thermal Insulation.
456.906 Standard Practice for the Installation of Organic Cellular Rigid Board Thermal Insulation.
456.907 Standard Practice for the Installation of Mineral Cellular Loose-Fill Thermal Insulation.
456.908 Standard Practice for the Installation of Reflective Insulation.
456.909 Certification Procedures for the Installation of Thermal Insulation Materials.
456.910 Standard Practice for the Installation of Storm Windows, Thermal Windows, Multiglazing Units and Storm Doors and Thermal Doors.
456.911 Standard Practice for the Installation of Clock Thermostats.
456.912 Standard Practice for the Installation of Insulation on Gas-Fired, Oil-Fired, and Electric Resistance Water Heaters.
456.913 Standard Practice for the Installation of Replacement Oil Burners for Energy Conservation.
456.914 Standard Practice for the Installation of Urea-Formaldehyde Foam Insulation. [Reserve]
456.915 Standard Practice for the Installation of Pipe Insulation. [Reserved]
456.916 Standard Practice for the Installation of Vent Dampers and Electric Ignition Devices. [Reserved]

Appendix A to Subpart I—ASTM and ANSI Standards.
Appendix B to Subpart I—National Electric Code Table 310-16 through 310-19.
Appendix C to Subpart I—Steady State Efficiency.
Appendix D to Subpart I—$CO_2$ Concentration in Flue Gas.

Appendix I to Part 456—Suggested Measures.
Appendix II to Part 456—Billing Disputes Resolution.

AUTHORITY: Part 1 of Title II of the National Energy Conservation Policy Act, Pub. L. No. 95-619, 92 Stat. 3206, *et. seq.*; Department of Energy Organization Act, Pub. L. No. 95-91, 91 Stat. 565, *et. seq.*, 42 U.S.C. 7101, *et seq.*

**Subpart A—General Provisions and Definitions**

**§ 456.101 Purpose and scope.**

This part contains the regulations to implement Part 1 of Title II of the National Energy Conservation Policy Act, Pub. L. No. 95-619 (references to NECPA hereinafter refer to Part 1 of Title II of the Act). NECPA requires the establishment of utility programs to encourage and facilitate the installation of energy conservation measures and renewable resource measures.

**§ 456.102 Petitions concerning conflicts of laws.**

(a) A utility making a petition required by a State Plan, a Nonregulat-

ed Utility Plan, or a Federal Standby Plan to determine whether the utility:

(1) Is prohibited by a State or local law or regulation from taking any action required to be taken under NECPA or any rule or Plan promulgated pursuant to NECPA, or

(2) Is required or permitted by a State or local law or regulation to take any action prohibited by NECPA or any rule or Plan promulgated pursuant to NECPA.

Shall file the petition with the Assistant Secretary for Conservation and Solar Applications, Department of Energy, 20 Massachusetts Avenue, NW., Washington, D.C. 20545. Any such petition shall contain a copy of the applicable State or local laws or regulations and a description of the action the utility believes it is prohibited from taking or is permitted or required to take under such laws or regulations.

(b) The Assistant Secretary shall give notice of the petition to the Governor, State Energy Office, and State Regulatory Authority of the applicable State and such other persons as the Assistant Secretary deems appropriate. Any such person or entity may file comments with the Assistant Secretary with respect to such petition within 30 days of receipt of the notice.

(c) If the Assistant Secretary, in consultation with the Administrator of the Economic Regulatory Administration, determines pursuant to such petition that a State or local law or regulation prohibits a utility from taking any action required to be taken under NECPA or any rule or plan promulgated pursuant to NECPA or permits or requires a utility to take any action prohibited by NECPA or any rule or plan promulgated pursuant to NECPA, the Assistant Secretary shall issue an order superseding such State or local laws or regulations to the extent inconsistent with NECPA or any rule or plan promulgated pursuant to NECPA. Such an order shall be effective with respect to all utilities otherwise subject to such State or local laws or regulations and shall moot any outstanding petitions under this Section by such utilities.

**§ 456.103 Appeals.**

(a) Any person aggrieved by any order, finding, or determination made under §§ 456.102, 456.502–456.505 may appeal that order, finding, or determination in accordance with Subpart H of Part 205 of these rules.

(b) Any person so aggrieved has not exhausted his administrative remedies until an appeal has been filed under that subpart and an order granting or denying the appeal has been issued.

**§ 456.104 List of covered utilities.**

(a) Before the beginning of each calendar year, the Department of Energy shall publish in the FEDERAL REGISTER a list of all covered utilities for that calendar year.

(b) Not later than 60 days after publication of the list, each State Regulatory Authority shall forward to the Secretary a copy of such list with designations as to which utilities on the list are under the jurisdiction of that Regulatory Authority.

(c) The publication of the list is for informational purposes, and the failure to include a covered utility on the list or the failure of a State Regulatory Authority to designate a utility subject to its jurisdiction in no way affects the duties of or requirements upon such covered utility under these rules or any plan promulgated pursuant to these rules.

**§ 456.105 Definitions.**

For purposes of this Part:

(a) *Covered Utility.* The term "covered utility" means in any calendar year a public utility which during the second preceding calendar year had either:

(1) Sales of natural gas for purposes other than resale which exceeded 10 billion cubic feet, or

(2) Sales of electric energy for purposes other than resale which exceed 750 million kilowatt-hours.

(b) *Eligible Customer.* The term "eligible customer" means a person who:

(1) Owns or occupies a residential building; and

(2) Purchases fuel from a covered utility or participating home heating supplier for use in such residential building.

(c) *Energy Audit.* The term "energy audit" means an on-site inspection of a residential building to determine:

(1) The estimated cost of purchasing and installing one or more suggested measures; and

(2) The estimated savings in energy costs that are likely to result from the installation of such measure(s).

(d) *Energy Conservation Measures.* The term "energy conservation measures" means the following measures in a residential building:

(1) *Caulking.* The term "caulking" means pliable materials used to fill small gaps at fixed joints on buildings to reduce the passage of air and moisture. Caulking includes, but is not limited to, materials commonly known as "sealants," "putty" and "glazing compounds."

(2) *Weatherstripping.* The term "weatherstripping" means narrow strips of material placed over or in movable joints of windows and doors to reduce the passage of air and moisture.

(3) *Furnace Efficiency Modifications.* The term "furnace efficiency modifications" means:

(i) *Replacement Furnaces or Boilers.* The term "replacement furnaces or boilers" means a new furnace or boiler, including a heat pump, which replaces an existing furnace or boiler using the same fuel and which reduces the amount of fuel consumed due to an increase in combustion efficiency, improved heat generation or reduced heat losses.

(ii) *Furnace Replacement Burner (Oil).* The term "furnace replacement burner (oil)" means a device which atomizes the fuel oil, mixes it with air, and ignites the fuel-air mixture, and is an integral part of an oil-fired furnace or boiler including the combustion chamber, and which because of its design, achieves a reduction in the oil used from that used by the device which it replaces.

(iii) *Flue Opening Modification.* The term "flue opening modification" means an automatically operated damper (often called a vent damper) which:

(A) Is installed downstream from the drafthood in gas-fired furnaces or downstream from the barometric damper in oil-fired furnaces;

(B) Is installed on a furnace which is located in a heated part of the building; and

(C) Conserves energy by substantially reducing the flow of heated air through the chimney when the furnace is not in operation.

(iv) *Electrical or Mechanical Ignition System.* The term "electrical or mechanical ignition system" means a device which, when installed in a gas-fired furnace or boiler, automatically ignites the gas burner and replaces a gas pilot light.

(4) *Ceiling Insulation.* The term "ceiling insulation" means a material primarily designed to resist heat flow which is installed between the conditioned area of a building and an unconditioned attic. Where the conditioned area of a building extends to the roofs, the term "ceiling insulation" also applies to such material used between the underside and upperside of the roof.

(5) *Wall Insulation.* The term "wall insulation" means a material primarily designed to resist heat flow which is installed with or on the walls between conditioned areas of a building and unconditioned areas of a building or the outside.

(6) *Floor Insulation.* The term "floor insulation" means a material primarily designed to resist heat flow which is installed between the first level conditioned area of a building and an unconditioned basement, a crawl space, or the outside beneath it. Where the first level conditioned area of a build-

ing is on a ground level concrete slab, the term "floor insulation" also applies to such material installed around the perimeter of or on the slab.

(7) *Duct Insulation.* The term "duct insulation" means a material primarily designed to resist heat flow which is installed on a heating or cooling duct in an unconditioned area of a building.

(8) *Pipe Insulation.* The term "pipe insulation" means a material primarily designed to resist heat flow which is installed on a heating or cooling pipe in an unconditioned area of a building.

(9) *Water Heater Insulation.* The term "water heater insulation" means a material primarily designed to resist heat flow which is in blanket form suitable for wrapping around the exterior surface of the water heater casing.

(10) *Storm Window.* The term "storm window" means a window or glazing material placed outside or inside an ordinary or prime window, creating an air space, to provide greater resistance to heat flow than the prime windows alone.

(11) *Thermal Window.* The term "thermal window" means a window unit with improved thermal performance through the use of two or more sheets of glazing material affixed to a window frame to create one or more insulated air spaces. It may also have an insulating frame and sash.

(12) *Storm or Thermal Door.* The term "storm or thermal door" means:

(i) A second door, installed outside or inside a prime door, creating an insulating air space,

(ii) A door with enhanced resistance to heat flow through the glass area by affixing two or more sheets of glazing material, or

(iii) A prime exterior door with a R-value of at least 2.

(13) *Heat Reflective and Heat Absorbing Window or Door Material.* The term "heat reflective or heat absorbing window or door material" means a window or door glazing material with exceptional heat-absorbing or heat-reflecting properties; or reflective or absorptive films and coatings applied to an existing window or door which thereby result in exceptional heat-absorbing or heat-reflecting properties.

(14) *Devices Associated with Electric Load Management Techniques.* The term "devices associated with electric load management techniques" means customer-owned or leased devices that reduce the maximum kilowatt demand on an electric utility and which are either:

(i) That part of a radio, ripple or other utility controlled load switching system on the customer's premises;

(ii) Clock-controlled load switching devices;

(iii) Interlocks, and other load-actuated, load-limiting devices; or

(iv) Energy storage devices with control systems.

(15) *Clock Thermostat.* The term "clock thermostat" means a device which is designed to reduce energy consumption by regulating the demand on the heating or cooling system in which it is installed, and uses:

(i) A temperature control device for interior spaces incorporating more than one temperature control level, and

(ii) A clock or other automatic mechanism for switching from one control level to another.

(16) *Energy Usage Display Meter.* The term "energy usage display meter" means a device the sole purpose of which is to display the cost (in money) of energy usage in the dwelling. It may show cost information for electricity usage, gas usage, oil usage, or any combination. The device may measure energy usage of the whole dwelling, or individual appliances or systems on an instantaneous or cumulative basis.

(e) *Energy Conserving Practices.* The term "energy conserving practices" means:

(1) *Changing Furnace and Air Conditioning Filters.* The term "changing furnace and air conditioning filters" means the replacement of disposable filters, or the cleaning of permanent filters, in forced air heating and cooling systems when the filters are sufficiently clogged with dust or lint to restrict the free flow of air through the filter.

(2) *Installing Flow Restrictor in Shower Head and Faucets.* The term "installing flow restrictor in shower heads and faucets" means placing a device in or on a shower head or faucet in order to limit the amount of water flowing through a shower head or faucet to a maximum of three gallons per minute.

(3) *Installing Low Flow Shower Heads and Faucets.* The term "installing low flow shower heads and faucets" means replacing regular shower heads or faucets with those having built-in provisions for limiting the amount of water flowing through the shower head or faucet to a maximum of three gallons per minute.

(4) *Sealing Leaks in Pipes and Ducts.* The term "sealing leaks in pipes and ducts" means the replacement of washers in leaking water valves, or the caulking of loose or poor-fitting joints in all ducts which permit the escape of conditioned air into unconditioned spaces; or the tightening, soldering, or plugging of leaking joints in hot water or steam heating pipes.

(5) *Setting Back Thermostats in Winter.* The term "setting back thermostats in winter" means manually lowering the thermostat control setting for the furnace during the heating season to a maximum of 55 °F. during sleeping hours and at other times when no one is home.

(6) *Reducing Thermostat Setting in Winter.* The term "reducing thermostat setting in winter" means limiting the maximum thermostat control setting for the furnace to 68 °F. during the heating season.

(7) *Setting Up Thermostat in Summer.* The term "setting up thermostats in summer" means setting the thermostat control for the air conditioning to 78 °F. or higher during the cooling season and turning the air conditioning off when no one is home.

(8) *Reducing Thermostat Settings on Water Heaters.* The term "reducing thermostat settings on water heaters" means the manual setback of the water heater thermostat control setting(s) to maintain the maximum water temperature at 120° F. (140° F. for homes with automatic dishwashers).

(9) *Closing Vents, Values and Doors in infrequently Used Rooms.* the term "closing vents, valves and doors in infrequently used rooms" means keeping vacant rooms from being needlessly heated or cooled by closing or blocking air vents from the furnace or central air conditioner or closing the radiator valves leading to the vacant rooms. Where the vacant rooms have individual cold air return vents, they are also closed or blocked. Doors to vacant rooms are also closed to keep the vacant rooms isolated from the rest of the housing having heated or cooled air.

(10) Such other practices designated by the Governor which save energy, do not require the installation of measures, and have an installed cost of less than $20.00.

(f) *Governor.* The term "Governor" means the Governor or chief executive officer of a State or his designee.

(g) *Home Heating Supplier.* The term "home heating supplier" means a person who sells or supplies home heating fuel (including No. 2 heating oil, kerosene, butane, and propane) to an eligible customer for consumption in a residential building.

(h) *Nonregulated Utility.* The term "nonregulated utility" means a public utility which is not a regulated utility.

(i) *Nonregulated Utility Plan.* The term "Nonregulated Utility Plan" means a plan developed pursuant to Subpart D of this part.

(j) *Participating Home Heating Supplier.* The term "participating home heating supplier" means a home heating supplier that has elected to participate in a State Residential Conservation Service Plan which includes home heating suppliers.

(k) *Program Announcement.* The term "Program Announcement" means the document required to be sent by a covered utility or participating home heating supplier to each eligible customer by § 456.306.

(l) *Program Information.* The term "program information" means the program announcement and any information dissemination activities related to a Residential Conservation Service Program.

(m) *Program Warranty.* The term "program warranty" means a warranty which certifies that a suggested measure will have a useful life of at least three years.

(n) *Public Utility.* The term "public utility" means any person, State agency, or Federal Agency which is engaged in the business of selling natural gas or electric energy, or both, to residential customers for use in a residential building.

(o) *Rate.* The term "rate" means any price, rate, charge, or classification made, demanded, observed, or received with respect to sales of electric energy or natural gas, any rule, regulation, or practice respecting any such rate, charge or classification, and any contract pertaining to the sales of electric energy or natural gas.

(p) *Ratemaking Authority.* The term "ratemaking authority" means authority to fix, modify, approve, or disapprove rates.

(q) *Regulated Utility.* The term "regulated utility" means a public utility with respect to whose rates a State regulatory authority has ratemaking authority.

(r) *Renewable Resource Measure.* The term "renewable resource measure" means the following measures in or with respect to a residential building:

(1) *Solar Domestic Hot Water Systems.* The term "solar domestic hot water systems" means equipment designed to absorb the sun's energy and to use this energy to heat water for use in a residential building other than for space heating, including thermosiphon hot water heaters.

(2) *Active Solar Space Heating Systems.* The term "active solar space heating systems" means equipment designed to absorb the sun's energy and to use this energy to heat living space by use of mechanically forced energy transfer, such as fans or pumps.

(3) *Combined Active Solar Space Heating and Solar Domestic Hot Water System.* The term "combined active solar space heating and solar domestic hot water system" means equipment designed to perform both of the functions described in paragraphs (r)(1) and (2) of this section.

(4) *Passive Solar Space Heating and Cooling Systems.* The term "passive solar space heating and cooling system" means systems that make most efficient use of, or enhance the use of, natural forces—including solar insolation, winds, night time coolness and opportunity to lose heat by radiation to the night sky—to heat or cool living space by the use of conductive, convective or radiant energy transfer. Passive solar systems include:

(i) *Direct Gain Glazing Systems.* the term "direct gain glazing systems" means the use of south-facing (+ or −45° of True South) panels of insulated glass, fiberglass, or other similar transparent substances that admit the sun's rays into the living space where the heat is retained. Glazing is either double-paned, or single-paned equipped with moveable insulation.

(ii) *Indirect Gain Systems.* The term "indirect gain systems" means the use of panels of insulated glass, fiberglass or other transparent substances that direct the sun's rays onto specially constructed thermal walls, ceilings, rockbeds, or containers of water or other fluids where heat is stored and radiated.

(iii) *Solaria/Sunspace Systems.* The term "solaria/sunspace systems" means a structure of glass, fiberglass or similar transparent material which is attached to the South-facing (+ or −45° of True south) wall of a structure which allows for air circulation to bring heat into the residence, and which are able to be closed off from the residential structure during periods of low solar insulation.

(iv) *thermal Pond Systems.* The term "thermal pond systems" means containers, such as tanks or water bags, filled with water or other fluids which, when placed on a roof-top, capture the sun's rays and radiates stored heat directly into the residence, and makes use of moveable insulation to regulate heat absorption and radiation.

(5) *Wind Energy Devices.* The term "wind energy devices" means equipment that uses wind energy to produce energy in any form for personal residential purposes.

(6) *Replacement Solar Swimming Pool Heaters.* The term "replacement solar swimming pool heaters" means devices which are used solely for the purpose of using the sun's energy to heat swimming pool water.

(s) *Residential Building.* The term "residential building" means any building used for residential occupancy which:

(1) Is not a new building to which final standards under Sections 304(a) and 305 of the Energy Conservation and Production Act apply,

(2) Contains at least one, but no more than four, dwelling units, and

(3) Has a system for heating or cooling, or both.

(t) *Residential Conservation Service (RCS) Program.* The term "Residential Conservation Service (RCS) Program" means the program required to be implemented by covered utilities pursuant to an approved State Plan, an approved Nonregulated Utility Plan, or a Federal Standby Plan.

(u) *Secretary.* The term "Secretary" means the Secretary of Energy.

(v) *State.* The term "State" means a State, the District of Columbia, and Puerto Rico.

(w) *State Agency.* The term "State agency" means a State, a political subdivision thereof, or any agency or instrumentality of either.

(x) *State Regulatory Authority.* The term "State regulatory authority" means any State agency which has ratemaking authority with respect to the sales of electric energy or natural gas by any public utility (other than by such State agency); except that in the case of a public utility with respect to which the Tennessee Valley Authority has ratemaking authority, such term means the Tennessee Valley Authority.

(y) *State Plan.* The term "State Plan" means a plan developed pursuant to Subparts B and C of this part.

(z) *Suggested Measures.* The term "suggested measures" means those energy conservation or renewable resource measures which the Secretary has by rule determined to be approprite by climatic region and building category and which are found in Appendix I to this part.

(aa) *Useful Life.* The term "useful life" means the period of time during which a suggested measure performs the purposes for which it was designed at a level consistent with those purposes.

### Subpart B—Preparation, Submission, and Approval of State Plans and Temporary Programs

#### § 456.201 Scope.

This Subpart identifies the responsibilities of the States and the Tennessee Valley Authority (TVA) in the preparation and submission of State Residential Conservation Service Plans, hereinafter referred to as "State Plans," if a State or the TVA chooses to submit a State Plan; the procedures for approval of the State Plan by the Secretary; and the procedures for submission and criteria for approval of Temporary Programs.

#### § 456.202 Initial Submission.

If a State intends to submit a State Plan, the Governor or State Agency specifically authorized by State law to submit a State Plan shall submit the following information to the Secretary:

(a) *Lead Agency.* Within 30 days of promulgation of these rules, the name and address of the State Agency, here-

inafter referred to as "Lead Agency," which has principal responsibility for the development of the State Plan. The Lead Agency shall be either:

(1) An Agency designated by the Governor to develop and submit a State Plan; or

(2) A State Agency specifically authorized by law to develop and submit a State Plan.

(b) *Nonregulated Utilities.* Within 30 days of promulgation of these rules, whether all nonregulated utilities operating in the State will be subject to the State Plan; and

(c) *Home Heating Suppliers.* Within 90 days of promulgation of these rules, whether or not any home heating suppliers will be included in the State Plan.

**§ 456.203 Coordination requirements.**

(a) *Among States.* The Lead Agency shall, to the extent feasible, coordinate the preparation of the State Plan with any other State which has jurisdiction over any covered utility or participating home heating supplier subject to the State Plan for the purpose of minimizing any inconsistent provisions governing such covered utility or participating home heating supplier.

(b) *Between the Lead Agency and the State Regulatory Authority.* If the Lead Agency is not the State Regulatory Authority, then the Lead Agency shall provide such Authority a copy of the proposed State Plan 30 days prior to the public hearing required by § 456.204.

**§456.204 Notice, Comment, and Public Hearing.**

Prior to submission of the State Plan to the Secretary for approval, the Governor or Lead Agency shall:

(a) *Notice and comment.* Provide meaningful public notice of the intention of the State to submit a State Plan. To be meaningful, this notice shall, at a minimum:

(1) Appear in newspapers of general circulation published in the State;

(2) Indicate where a copy of and information pertaining to the proposed State Plan can be obtained;

(3) Indicate the date, time, and location of each public hearing to be held pursuant to paragraph (b) of this section at least 30 days prior to such hearing; and

(4) Invite public comments on the content of the proposed State Plan, with at least 30 days notice.

(b) *Hearing.* Hold at least one public hearing in the State for the purpose of hearing testimony and receiving comments on the content of the proposed State Plan.

**§ 456.205 Procedures for submission and approval of State plans.**

(a) *Who shall submit.* Ten (10) copies of the proposed State Plan shall be submitted by either:

(1) The Governor of the State;

(2) The Lead Agency; or

(3) The TVA with respect to all covered utilities over which the TVA has ratemaking authority.

(b) *Time for submission.* The proposed State Plan shall be submitted within 180 days of promulgation of these rules. The time for submission may be extended by the Secretary if:

(1) The Governor or Lead Agency requests an extension at least 10 days prior to the formal deadline; and

(2) Good cause is shown for allowing an extension.

(c) *Approval.* (1) If a proposed State Plan meets the criteria of Subparts B and C of this Part, the Secretary shall approve it within 90 days of the date the proposed State Plan was submitted .

(2) Within 180 days after the date of approval of a State Plan, the Lead Agency shall provide to the Secretary a statement certifying whether or not all covered utilities and home heating suppliers subject to the State Plan are in compliance with the State Plan.

(3) The Lead Agency shall, within 30 days of approval of the State Plan:

(i) Inform covered utilities subject to the State Plan and participating home heating suppliers of the contents of the State Plan;

(ii) Direct such covered utilities and participating home heating suppliers to comply with the State Plan; and

(iii) Inform such covered utilities and participating home heating suppliers of the State and Federal procedures for investigating and enforcing compliance with State Plan.

(d) *Disapproval.* (1) If a proposed State Plan does not meet the criteria of Subparts B and C of this part, the Secretary shall, within 90 days of the date the proposed State Plan was submitted, disapproved the proposed State Plan in writing and shall specify in writing the grounds for disapproval.

(2) Within 60 days of the date of disapproval of a proposed State Plan, or such longer period as the Secretary may determine pursuant to the criteria of paragraph (b) of this section, the Governor or Lead Agency may submit another proposed State Plan. Except for the time in which a proposed State Plan must be submitted, all procedures of this Subpart for submission of the original proposed State Plan shall be applicable to the submission of any proposed State Plan submitted after initial disapproval.

(e) *Amendments.* (1) The Governor or Lead Agency may submit proposed amendments to an approved State Plan at any time.

(2) Except for the time in which a proposed State Plan must be submitted, all procedures of this Subpart for submission of the original State Plan shall be applicable to the submission of proposed amendments to any approved State Plan.

**§ 456.206 Home heating suppliers.**

If the Governor or Lead Agency submits a plan applicable to home heating suppliers in the State, it shall be a part of the State Plan and shall be submitted in accordance with the procedures of this Subpart applicable to the submission of the State Plan.

**§ 456.207 Tennessee Valley Authority (TVA).**

In this part, except as otherwise specified, references to the Lead Agency shall be deemed to refer also to the TVA and references to the State Plan shall be deemed to refer also to the TVA Plan. References in this Part to a State as a geographic area shall, with respect to the TVA Plan, be references to the service areas of the covered utilities subject to the TVA Plan. If the TVA chooses to submit a Residential Conservation Service Plan, it shall be subject to the following exceptions and additional requirements:

(a) *Exclusion from initial submission.* The TVA need not submit the Initial Submission as required in § 456.202. However, the TVA shall notify the Secretary within 30 days after promulgation of these rules of the person(s) in charge of its Residential Conservation Service Program.

(b) *Coordination requirement.* The TVA shall coordinate its Residential Conservation Service Plan with each State Plan developed by a State in which the utilities covered by the TVA Plan are located.

(c) *Exclusion of home heating suppliers.* The TVA Plan shall not cover home heating suppliers.

**§ 456.208 Temporary programs.**

(a) *Definition of temporary program.* A Temporary Program is a plan or a part of a State Plan which exempts in whole or in part for a specified period, to be determined by the Secretary, but not to exceed three years from the date of approval of such Temporary Program, one or more utilities from one or more of the following provisions:

(1) The requirements for preparing and distributing the Program Announcement described in § 456.306;

(2) The requirments for offering and performing audits described in § 456.307;

(3) The requirements for offering and arranging installation of suggested measures described in § 456.308;

(4) The requirements for offering and arranging financing for the sale or installation of suggested measures described in § 456.309;

(5) The requirement concerning accounting and payment of costs described in § 456.310;

(6) The requirements regarding billing of costs, repayment of loans, and termination of service described in § 456.311;

(7) The requirements for distributing the lists described in § 456.312(c); and

(8) The prohibition against supplying, installing, or financing by covered utilities described in § 456.502(a).

(b) *Who may submit.* A proposed Temporary Program may be submitted to the Secretary by either:

(1) The Governor of a State;

(2) A covered utility which is included in a State Plan with the support of the Governor; or

(3) A nonregulated utility not included in a State Plan.

(c) *Time for submission.* A proposed Temporary Program shall be submitted to the Secretary within 180 days of promulgation of these rules.

(d) *Approval.* (1) The Secretary shall approve or disapprove a proposed Temporary Program within 90 days of receipt of the proposed Temporary Program or later if he so notifies the person who submitted the proposed Temporary Program.

(2) The Secretary may approve a Temporary Program for a period not to exceed three years from the date of approval.

(3) Approval shall be conditioned upon periodic review by the Secretary to determine whether the grounds for approval still exist. Upon determination by the Secretary that such grounds for approval no longer exist, the Temporary Program shall be terminated.

(e) *Criteria for approval.* The Secretary shall approve a proposed Temporary Program only if the person submitting the proposed Temporary Program demonstrates to the Secretary's satisfaction that the Temporary Program:

(1) Contains adequate procedures to assure that each covered utility under such program will charge fair and reasonable prices and rates of interest to its eligible customers in connection with the purchase and installation of residential energy conservation measures;

(2) Contain adequate procedures for preventing unfair, deceptive, or anticompetitive acts or practices affecting commerce which relate to the implementation of such program;

(3) Is likely to result in the installation of all suggested measures in at least as many residential buildings as would have been installed had such utility not been exempt from the requirements for which exemption is sought; and

(4) Contains a provision for submitting such periodic reports as the Secretary may require.

(f) *Federal Standby Authority.* The Federal Standby Authority described in Subpart F of this part shall not be exercised with respect to a covered utility which either:

(1) Is subject to an approved Temporary Program;

(2) Is proposed for inclusion under a proposed Temporary Program which has been submitted in accordance with paragraph (c) of this section, but has not yet been approved or disapproved by the Secretary; or

(3) Was subject to an approved Temporary Program which has terminated and such covered utility will be subject, within a reasonable time, to be determined by the Secretary, to an adequately implemented approved State or Nonregulated Utility Plan.

### Subpart C—Content of State Plans

#### § 456.301 Scope.

This subpart prescribes the minimum requirements for the content of State Plans. The State may include additional information and provide additional requirements for the Residential Conservation Service Program if such information and requirements are not specifically prohibited by these rules or by any applicable law or regulation. All references in this Subpart to covered utilities apply to regulated and nonregulated covered utilities subject to the State Plan.

#### § 456.302 Coverage of State Plan.

(a) *Regulated Utilities.* All regulated utilities providing utility service in a State which meet the definition in § 456.105(a) shall be subject to the State Plan.

(b) *Nonregulated Utilities.* The State Plan shall state whether or not it covers nonregulated utilities.

(c) *Home Heating Suppliers.* The State Plan shall state whether or not it includes a Residential Conservation Service Program for home heating suppliers.

(d) *Temporary Programs.* The State Plan shall identify the covered utilities, if any, for which a request for a Temporary Program has been submitted and described or attach such program for each such utility.

#### § 456.303 Procedures for Investigating and Enforcing Compliance with the State Plan.

(a) *Investigation and Enforcement.* (1) The State Plan shall require each covered utility and each participating home heating supplier to comply with the State Plan.

(2) The State Plan shall contain adequate procedures for investigating and enforcing compliance with the State Plan by covered utilities and participating home heating suppliers.

(3) The State Plan shall cite and describe the existing or proposed State authority(ies) for such investigation and enforcement, including authorities with respect to any nonregulated utility covered in the State Plan.

(4) The State Plan shall identify the State agency(ies) responsible for such investigation and enforcement and shall include a description of the resources available for such investigation and enforcement.

(b) *Conflicts of Laws.* The State Plan shall require each covered utility to petition the Assistant Secretary for Conservation and Solar Applications in accordance with § 456.102:

(1) Whenever the utility believes it is prohibited by a State or local law or regulation from taking any action required to be taken under NECPA or any rule or State Plan promulgated pursuant to NECPA; or

(2) Whenever the utility believes it is required or permitted by a State or local law or regulation to take any action prohibited by NECPA or any rule or State Plan promulgated pursuant to NECPA.

#### § 456.304 Exemptions and Waivers for Utility Supply, Installation, and Financing.

The State Plan shall:

(a) Require that each covered utility which supplies, installs, or finances any energy conservation or renewable resource measure pursuant to §§ 456.503–456.505 be listed as a supplier, installer or lender, as appropriate, pursuant to § 456.312 in the same manner and subject to the same requirements as any other supplier, installer, or lender.

(b) Contain a list of all covered utilities engaged in supplying, installing, or financing energy conservation or renewable resource measures pursuant to § 456.506(a), including with respect to each such utility a specific description of those supply, installation, or finance activities.

(c) Contain procedures specifically describing how each covered utility listed in paragraph (b) of this section will comply with the requirements of the State Plan mandated by this subpart in light of the exemption in § 456.506(b).

(d) Contain procedures to ensure that covered utilities which supply, install or finance the sale or installation of energy conservation or renewable resource measures pursuant to §§ 456.503–456.505 shall:

(1) Charge fair and reasonable prices and interest rates, which shall be determined by periodic review of com-

parative prices and interest rates by a State designated agency;

(2) Not discriminate unfairly among eligible customers; and

(3) When financing energy conservation or renewable resources measures, not discriminate unfairly among suppliers, among contractors, or among suggested measures.

**§ 456.305 Scope of benefits.**

(a) The State Plan shall describe what action by an eligible customer shall entitle such customer to the following benefits:

(1) The program warranty defined in § 456.105(m).

(2) Guarantee of compliance with any standard found in Subparts G, H, and I and with the listing requirements in § 456.312(b).

(3) Enforcement of standards through the inspections described in § 456.313.

(4) Billing of services as described in § 456.311; and

(5) Access to the conciliation conference described in § 456.315(a).

(b) At a minimum the above benefits shall be available to each eligible customer when a covered utility or participating home heating supplier arranges installation of any suggested measure in such customer's residence as required by § 456.308.

(c) At a minimum the benefits in Subsections (a) (4) and (5) and the benefits guaranteed by the listing requirements in § 456.312(b)(3) shall be available to each eligible customer when a covered utility or participating home heating supplier arranges financing, as required in § 456.309, for the purchase or installation of any suggested measure installed in such customer's residence.

**§ 456.306 Program Announcement.**

(a) *Distribution and Content.* The State Plan shall require each covered utility and each participating home heating supplier to send to each eligible customer, no later than six months after approval of the State Plan and every two years thereafter until January 1, 1985, a Program Announcement which shall:

(1) List the suggested measures for the category of residential buildings owned or occupied by such eligible customer;

(2) Include a reasonable estimate of the savings in energy costs, expressed in dollars, for a specified period of time, which are likely to result from such installation;

(3) List the energy conserving practices and state that the initial cost, if any, of each practice is less than twenty (20) dollars;

(4) Inculde a reasonable estimate of the savings in energy costs, expressed in dollars, for a specified period of time, likely to result from the adoption of each practice;

(5) For each of the services required to be offered under §§ 456.307 (Energy Audits), 456.308 (Arranging Installation), 456.309 (Arranging Financing), and 456.312(c) (List Distributed to Eligible Customers):

(i) Offer and describe the service;

(ii) Explain how the eligible customer may request the service; and

(iii) List the direct cost, if any, of receiving the service;

(6) With respect to the benefits listed in § 456.305(a), describe under what circumstances such benefits may be obtained.

(7) Include the following disclosure or its equivalent:

Energy savings and installation costs depend on many factors. The estimates contained in this program announcement are based on simulations of typical houses. Your costs and savings will be different if your house is a different size or type, if you family is a different size, or if your energy using habits are different from those we assumed. The energy audit which we offer will provide more specific estimates for your home.

(8) In the case of electric utilities, include, if load management devices are not suggested measures for the eligible customer, the following diclosure or its equivalent:

Electric load management devices are not suggested measures in our area. Although an investment in load management might save energy through more efficient electric energy generation, there would be no direct savings to you because we do not offer load control rates or time-of-use rates.

(9) Not include any advertising for any suggested measure or for any supplier, contractor, or lender. If the covered utility or participating home heating supplier which distributes the Program Announcement, supplies, installs or finances the sale or installation of suggested measures, the Program Announcement may so state.

(10) Not include any information regarding any product which is not an energy conservation measure, a renewable resource measure, or energy conserving practice.

(b) *Categories of Residential Buildings.* As used in this part, the term "categories" means, with respect to residential buildings, the categories listed in this subsection for each suggested measure.

(1) For each suggested energy conservation measure, the categories are:

(i) "Gas space heating", which means those residential buildings in which natural gas is the principal space heating fuel;

(ii) "Oil space heating", which means those residential buildings in which #2 heating oil, or any other fuel besides natural gas or electricity, is the principal space heating fuel;

(iii) "Electric space heating", which means those residential buildings in which electricity is the principal space heating fuel;

(2) For solar domestic hot water systems, the categories are:

(i) "Gas water heating", which includes those residential buildings in which natural gas is the principal fuel for domestic water heating;

(ii) "Oil water heating", which includes those residential buildings in which #2 heating oil, or any other fuel except natural gas or electricity, is the principal fuel for domestic water heating.

(iii) "Electric water heating", which includes those residential buildings in which electricity is the principal fuel for domestic hot water heating.

(3) For active solar space heating systems, there are nine categories, which are "gas space heating", "oil space heating", "electric space heating", with respect to the following building types:

(i) "Single-family detached", which includes any residential building which contains only one dwelling unit and which is not attached to any other residential building;

(ii) "Attached buildings", which includes any residential building which either contains more than one dwelling unit or which is attached to another residential building or both; and

(iii) "Mobile homes".

(4) For passive solar space heating and cooling systems, the category is "all residential buildings".

(5) For wind energy devices, the category is "all residential buildings".

(6) For replacement solar swimming pool heaters, the categories are:

(i) "Residential buildings with heated swimming pools"; and

(ii) "Residential buildings without heated pools".

(c) *Calculation Procedures.* The State Plan shall, with respect to the estimates of the cost and savings included in the Program Announcement:

(1) Describe the procedures by which such estimates shall be made;

(2) Require that such estimates be based on prices for fuel and suggested measures and on climate data which are representative of those for the location of each eligible customer; and

(3) Assure that:

(i) if an eligible customer receives two or more Program Announcements from different covered utilities or participating home heating suppliers, the cost and savings estimates required in paragraph (a) of this section are identical; and

(ii) Such estimates in Program Announcements distributed in different parts of the state are consistent. Consistent means identical except for variations in the characteristics of typical homes and in the price and climate

data applicable in the different parts of the State.

(d) *New Customers.* (1) The State Plan shall require that each covered utility and participating home heating supplier send a Program Announcement which meets the requirements of this section to each person who becomes an eligible customer after initial distribution of the Program Announcement but before January 1, 1985.

(2) The State Plan shall require that each new customer shall receive the Program Announcement within 60 days of becoming an eligible customer.

(3) The State Plan shall require that covered utilities and participating home heating suppliers inform each such new customer that upon request the customer may receive a copy of the results of any energy audit of the customer's residence which the covered utility or participating home heating supplier may have performed pursuant to the State Plan and require that upon such a request such utility or home heating supplier provide such results.

**§ 456.307 Requirements for Energy Audits.**

(a) *What Energy Audits Must Be Provided.* The State Plan shall describe the energy audit services to be offered by covered utilities and participating home heating suppliers and shall require at a minimum that each covered utility and participating home heating supplier provide to each eligible customer upon request by such eligible customer:

(1) An energy audit which addresses all energy conserving practices, all suggested energy conservation measures, and no other suggested measures except, at the discretion of the State, solar domestic hot water heating systems where they are a suggested measure; and

(2) An energy audit of each suggested renewable resource measure, which may be provided as a group or separately, as determined by the State.

(b) *Timing and Preconditions.* (1) The State Plan shall specify a reasonable time within which each covered utility and participating home heating supplier shall provide energy audits to eligible customers requesting such audits.

(2) The State Plan shall prohibit covered utilities and participating home heating suppliers from requiring as a precondition of providing an energy audit to an eligible customer that such customer purchase or perform any other method of estimating energy saving potential, including "Class B" audits as defined in the "Energy Audit Procedures" published by the Federal Energy Administration at 10 CFR 450.11.

(3) The State Plan shall prohibit covered utilities and participating home heating suppliers from discriminating unfairly among eligible customers in providing energy audits.

(c) *Results of Audit.* (1) The State Plan shall require that the auditor, in person, provide the following information in writing to each eligible customer who receives an energy audit:

(i) An estimate, which meets the requirements of paragraph (d) of this section, of the cost of hiring a contractor to install each suggested measure addressed by the energy audit in the eligible customer's residence, including materials and labor and including any site preparation or structural alterations or modifications necessary for installation of each measure;

(ii) An estimate, which meets the requirements of paragraph (d) of this section, of the savings in energy costs, expressed in dollars, which would occur over a specified time period, from installation of the suggested measures addressed by the energy audit in the eligible customer's residence;

(iii) The following disclosure or its equivalent:

> The procedures used to make these estimates have been tested by the state. This testing assures that the estimates are a reasonable basis for your decision making, within the cost limitations of our program. However, the savings you actually get from installing these suggested measures may be different from the estimates contained in this audit report. Though the estimates are based on measurements of your house, they also are based on many assumptions which may not be correct for your house.

(iv) A list of the energy conserving practices which are likely to reduce energy costs for the eligible customer; and

(v) With respect to any renewable resource measure addressed by the energy audit, the following additional written information shall be provided to the customer:

(A) An estimate of the annual maintenance costs of such measure;

(B) With respect to an energy audit addressing a solar hot water system or a solar domestic space heating system, or a combination thereof, a description of the solar device used by the auditor in preparing energy savings estimates which shall include the following information:

(*1*) Square feet of collector;

(*2*) Collector characteristics, including glazing materials and other collector materials;

(*3*) Storage system, including the capacity of storage and the number of storage tanks;

(*4*) Freeze protection necessary; and

(*5*) The following disclosure:

> The energy cost savings estimates you receive are based on systems which may be different than the ones you purchase. Also, these estimates were not determined using actual conditions but using simulated measurements. Therefore, the cost savings we have estimated may be different from the savings which actually occur.

(C) With respect to an energy audit addressing passive solar space heating and cooling systems:

(*1*) The name of the particular device considered by the auditor;

(*2*) A description of the system and its function, and

(*3*) The disclosure provided in subdivision (v)(B)(*5*) of this subparagraph.

(D) With respect to an energy audit addressing a wind energy system, a description of the device which shall include the following information:

(*1*) Rated output at stated wind velocity expressed as usable power generated;

(*2*) Control system for the device;

(*3*) Braking safing;

(*4*) Location and height of proposed device;

(*5*) Proximity of device to public areas or easements which may create safety problems;

(*6*) Survival wind;

(*7*) Annual energy production in Kwhr/yr;

(*8*) Types of power produced: AC, DC, or cycles; and

(*9*) The disclosure provided in subdivision (ii)(E) of this subparagraph.

(2) The State Plan shall prohibit any covered utility from providing any estimate to any eligible customer of the cost of purchase of furnace efficiency modifications or load management devices for installation by the eligible customer.

(d) *Calculation and Audit Procedures.* (1) The State Plan shall require that the estimates of energy cost savings and of installation costs provided as a result of an energy audit shall:

(i) Be based on local fuel prices, local prices for materials and installation of suggested measures, and local climate data for the eligible customer's location;

(ii) Be based on actual measurements of the eligible customer's residence taken by the energy auditor; and

(iii) Provide clear indication to the eligible customer, through sample calculation or disclosure, that the total energy cost savings from the installation of several suggested measures will be less than the energy cost savings of each suggested measure installed individually.

(2) The State Plan shall require that any energy audit which includes an audit of an oil furnace or boiler system shall include a test of the steady-state efficiency of such furnace or boiler.

(3) The State Plan shall contain adequate procedures to:

(i) Assure that if an eligible customer receives energy audits addressing

the same suggested measures from two or more covered utilities, the results of these audits are based on the same data for fuel prices, prices for materials and installation of suggested measures, and climate; and

(ii) Assure that all methods used for determining which measurements shall be taken and which calculation procedures shall be used in all energy audits carried out under the State Plan are evaluated by the State to assure accuracy before they are implemented.

(e) *Additional Information.* The State Plan shall require that the auditor present the following information in person to each eligible customer who receives an energy audit:

(1) A description of the arrangements for installations and financing of suggested measures offered by the covered utility pursuant to the State Plan;

(2) The lists of contractors, suppliers, and lenders developed pursuant to the State Plan;

(3) An explanation of the complaint processing procedures described in § 456.315, including information on who is eligible for such procedures and how to gain access to them;

(4) A statement of the circumstances under which the DOE-approved standards for materials and installation of suggested measures apply; and

(5) A statement of the existence of the program warranties for suggested measures and the circumstances under which such warranties are required.

(f) *Prohibitions and Disclosure.* (1) The State Plan shall prohibit the auditor from estimating, as part of any energy audit provided pursuant to the State Plan, the costs or energy cost savings of installing any product which is not a suggested measure unless the auditor specifically states that such product is not a suggested measure.

(2) The State Plan shall prohibit any auditor from recommending any supplier, contractor, or lender who supplies, installs, or finances the sale or installation of any suggested measure, if such recommendation would unfairly discriminate among such suppliers, contractors, or lenders. If a covered utility or participating home heating supplier which arranged the audit, supplies, installs or finances the sale or installation of suggested measures, the auditor may so state.

(3) The State Plan shall require that each energy auditor provide the eligible customer with a written statement of any interest which the person or the person's employer has, directly or indirectly, in the sale or installation of any suggested measure.

(g) *Furnace Audits.* The State Plan shall require that, in order for an auditor of a covered utility or participating home heating supplier to audit a furnace which uses as its primary source of energy any fuel or source of energy other than the fuel or source of energy sold by the covered utility or participating home heating supplier, the eligible customer must request such audit by signing a form which includes the following statement:

If your home is heated by a source of fuel other than [ ], only the supplier of the other fuel may audit your furnace unless you specifically request an audit. Federal law requires that such a request be in writing. If you want us to audit your furnace, although we do not supply the fuel for it, please sign below.

(h) *Qualifications for Auditors.* The State Plan shall require that each person who performs an energy audit pursuant to the State Plan shall:

(1) Be qualified according to the applicable procedures in § 456.314;

(2) Be under contract to, be an employee of, or be an employee of a contractor to a covered utility or participating home heating supplier;

**§ 456.308 Arranging Installation.**

The State Plan shall:

(a) Require each covered utility and participating home heating supplier to arrange installation of any suggested measure upon request by any eligible customer.

(b) Describe these arrangement services which shall, at a minimum, include a service to the eligible customer beyond the distribution of the lists required by § 456.312(c).

(c) Require each covered utility and participating home heating supplier to provide such arrangement service within a reasonable period of time, which shall be specified in the State Plan, from receipt of a request for such service.

(d) Prohibit each covered utility and participating home heating supplier, when arranging installation of suggested measures, from recommending, selecting, or providing information regarding any supplier or contractor if such recommendation, selection, or information would unfairly discriminate among suppliers and contractors of suggested measures. The State Plan may allow covered utilities or participating home heating suppliers that supply or install suggested measures to so inform the customers.

(e) Prohibit each covered utility and participating home heating supplier, when arranging installation of suggested measures, from discriminating unfairly among eligible customers, among suppliers, among contractors, or among suggested measures.

(f) Prohibit each covered utility and participating home heating supplier from arranging installation with any person not in the Master Record.

**§ 456.309 Arranging Financing.**

The State Plan shall:

(a) Require each covered utility and participating home heating supplier to arrange financing for the supply and installation of any suggested measure upon request by any eligible customer.

(b) Describe these arrangement services which shall, at a minimum, include a service to the eligible customer beyond the distribution of the lists required by § 456.312(c).

(c) Require each covered utility and participating home heating supplier to provide such arrangement service within a reasonable period of time, which shall be specified in the State Plan, from receipt of a request for such service.

(d) Prohibit each covered utility and participating home heating supplier, when arranging financing for the purchase or installation of suggested measures, from recommending, selecting, or providing information regarding any lender if such recommendation, selection, or information would unfairly discriminate among lenders that finance the purchase or installation of suggested measures. The State Plan may allow covered utilities or participating home heating suppliers that finance suggested measures to so inform the customer.

(e) Prohibit each covered utility and participating home heating supplier, when arranging financing of suggested measures, from discriminating unfairly among eligible customers, among suppliers, among contractors, among lenders, or among suggested measures.

(f) Prohibit each covered utility and participating home heating supplier from arranging financing with any person not in the Master Record.

**§ 456.310 Accounting and Payment of Costs.**

(a) *Accounting.* The State Plan shall require that covered utilities use the following accounts and procedures:

(1) All amounts expended or received by a covered utility which are attributable to the Residential Conservation Service Program, including any penalties paid under Subpart F (Federal Standby Authority) shall be accounted for on the books and records separately from amounts attributable to all other activities of the covered utility.

(2) Covered utilities subject to the jurisdiction of the Federal Energy Regulatory Commission (FERC) shall utilize the Uniform System of Accounts as prescribed in Title 18, CFR Parts 101, 104, 201 and 204. Covered rural electric cooperatives shall utilize the Uniform System of Accounts as prescribed by the Rural Electrification Administration (REA) in Title 7, CFR Part 1701, Appendix A. Other covered nonregulated utilities shall adopt ac-

counts within their accounting system with the attributes of the appropriate accounts prescribed by the FERC.

(i) All amounts expended by a covered utility for the Residential Conservation Service Program shall be charged to subaccounts of Account 908, Customer Assistance Expenses, its equivalent or its successor if changed by FERC or REA. Appropriate records shall be maintained thereunder so as to allow ready identification of costs attributable to the following program elements:

(A) Program Information;

(B) Energy Audit;

(ii) Billed income attributable to the Residential Conservation Service Program shall be accounted for in subaccounts within Account 456, Other Electric Revenue (for electric utilities), or Account 495, Other Gas Revenue (for gas utilities), their equivalents, or their successors if changed FERC or REA.

(b) *Payment of Costs.* The State Plan shall require that covered utilities treat costs as described below and shall describe how the costs described in paragraph (b)(3)–(5) of this section are treated.

(1) All amounts expended by a covered utility for the Program Announcement and all public education and program promotion directly related to providing information about a utility's Residential Conservation Service Program shall be treated as a current expense of providing utility service and be charged to all ratepayers of the covered utility in the same manner as other current operating expenses of providing such utility service.

(2) All amounts expended by a covered utility for labor and materials in connection with the purchase or installation of any energy conservation or renewable resource measure shall be charged to the residential customer for whom such activity is performed. (Interest expenses associated with utility loans are to be treated in accordance with paragraph (b)(5) of this section.)

(3) The following program elements are to be treated as a current operating expense consistent with paragraph (b)(1) of this section or be charged to the eligible customer, consistent with paragraph (b)(2) of this section or any combination thereof. This determination shall be made by the State regulatory authority for all regulated utilities covered by the State Plan and individually by each nonregulated utility covered by the State Plan. The costs include:

(i) Administrative and general expenses associated with audits, list distribution and "arranging." These administrative costs may include, but are not limited to any costs the utility incurs in conducting the random post-installation inspections required by § 456.313(b) and the conciliation conferences required by § 456.315(a).

(ii) Project manager requirements, including:

(A) The energy audit;

(B) Arranging for a lender to make a loan to an eligible customer to finance the purchase and installation costs of energy conservation and renewable resource measures, including repayment of the principal and interest of a loan as part of the periodic bill;

(C) Arranging to have the suggested measures installed.

(4) Costs incurred by a covered utility for services carried out by such utility on behalf of the State may be reimbursed by the State.

(5) The interest cost on a loan made by a covered utility to an eligible customer and costs, other than those in paragraph (b)(1), (2), or (3) of this section, associated with the covered utility's Residential Conservation Service Program, shall be charged to the eligible customer for whom such activity is performed. *Exception.* These items may be treated as a current expense consistent with paragraph (b)(1) of this section if the State regulatory authority, or the nonregulated utility, as appropriate, finds, after public notice and opportunity for public hearing, that the expensing of these costs is likely to result (by reason of reduction in demand for energy) in lower rates for its ratepayers than would occur if the covered utility did not treat such costs as a current expense.

(c) *Duplication of Audits.* In areas where a residential customer is an eligible customer of more than one covered utility, the State regulatory authority or the covered nonregulated utility, as appropriate, may condition the expensing of energy audits, in accordance with paragraph (b)(3) of this section, upon the establishment of procedures to ensure that each eligible customer may receive only one free or subsidized audit.

**§ 456.311 Billing of costs, repayment of loans, and termination of service.**

The State Plan shall require that:

(a) *Billing of Costs.* (1) Any portion of the costs of carrying out any activity pursuant to the State Plan which is charged to the eligible customer for whom such activity is performed, and is included on such customer's utility or fuel bill, shall be stated separately in such bill from the cost of providing utility or fuel service; and

(2) When any portion of the costs of carrying out any activity pursuant to the State Plan are included on a utility or fuel bill, payments received for such bill shall be first charged to pay for the purchase of utility or fuel service and only the excess shall be credited to charges for the other costs, unless the eligible customer requests an alternative distribution of payments.

(b) *Repayment of Loans.* (1) In the case of any loan made by a covered utility or a participating home heating supplier under the Residential Conservation Service Program, the covered utility or participating home heating supplier shall permit the eligible customer to repay the principal and interest of that loan as a part of his periodic utility or fuel bill over a period of not less than three years, unless the eligible customer chooses a shorter repayment period.

(2) Under the circumstances described in the State Plan pursuant to § 456.305, an eligible customer shall be permitted to repay a loan by a lender other than the covered utility or the participating home heating supplier, as part of his periodic utility or fuel bill, if the lender agrees to repayment in such manner.

(3) In the case of any loan under the Residential Conservation Service Program which an eligible customer repays as a part of the periodic bill for utility or fuel service, if the customer notifies the utility or participating home heating supplier in writing and states why the bill is believed to contain an error, and the covered utility or participating home heating supplier receives such notification within 90 days from the mailing of any bill reflecting the alleged error, the procedures for resolving billing error disputes in appendix II of this Part shall apply.

(4) In the case of any loan made under the Residential Conservation Service Program for purchase and installation of suggested measures:

(i) A lump-sum payment of outstanding principal and interest may be required by the lender upon default (as determined under applicable law) in payment by the eligible customer; and

(ii) No penalty shall be imposed by the lender for payment of all or any portion of the outstanding loan amount prior to the date such payment would otherwise be due.

(c) *Termination of Service.* When an eligible customer is making a payment for the purchase or installation of any suggested measure as part of such customer's periodic utility or fuel bill the covered utility or participating home heating supplier shall not terminate or otherwise restrict utility or fuel service to such customer for any default by such customer for such payments.

**§ 456.312 Lists of suppliers, contractors, and lenders.**

(a) *Master Record.* The State Plan shall contain procedures for the preparation of a Master Record of all suppliers, contractors, and lenders who

sell, install, or finance suggested measures in the State. These procedures shall, at a mimimum:

(1) Identify the agency(ies), hereinafter referred to as the "Listing Agency," which shall be responsible for the preparation and maintenance of the Master Record. The Listing Agency shall not be a regulated utility.

(2) Attempt to inform all suppliers, contractors, and lenders who sell, install or finance suggested measures in the State of the pending compilation of the Master Record and the intended use of the Master Record, and provide them an opportunity through effective notice to apply for inclusion in the Master Record. At a minimum, the following methods of notice shall be used:

(i) Publication in newspapers of general circulation in the State; and

(ii) Direct notification of appropriate trade associations.

(3) Ensure that all persons who agree to comply with the requirements of paragraph (b) of this section, and only such persons, are included in the Master Record.

(4) Ensure that persons not included in the original or existing Master Record who meet the criteria of paragraph (b) of this section are added to the Master Record within a resonable time after applying for inclusion.

(5) Ensure that all persons in the Master Record who fail to comply with the requirements of paragraph (b) of this section are removed from the Master Record. The State Plan shall establish the criteria by which such failure shall be grounds for removal from the Master Record. Removal procedures shall ensure that each person proposed for such removal shall have:

(i) An opportunity to file a complaint through and participate in, the redress proceeding and civil action described in § 456.315 for the purpose of protesting such removal; and

(ii) Access to the records of the Listing Agency regarding the inspections of work performed by such person.

(6) Ensure that the name and address of any supplier, contractor or lender who has been added to or deleted from the Master Record are forwarded to the appropriate covered utilities or home hearing suppliers within one month of such addition or deletion.

(b) *Requirements for Inclusion in the Master Record.* (1) The State Plan shall require that, when installing suggested measures under the circumstances described by the State Plan pursuant to § 456.305, all installation contractors included in the Master Record shall:

(i) Comply with any applicable installation standards found in Subparts G and I of this part and install materials which comply with any applicable standards found in Subparts G and H of this part;

(ii) Install only measures covered by the program warranty defined in § 456.105(m);

(iii) Furnish the customer with a written contract detailing the job to be performed and its cost, and certifying that any applicable State Plan requirements for installation and material standards will be compiled with;

(iv) Assure that all individuals who are employed or otherwise retained by the contractor to install vent dampers or electrical ignition systems have been qualified pursuant to the applicable provisions of §§ 456.314(c)–(e);

(v) Include in every contract a guarantee that the contractor will correct any violation of the standards in Subparts G through I of this part without cost to the customer;

(vi) Include in every contract for installation of a vent damper, electronic ignition devices, or wind energy system a guarantee to correct any violation of the standards in Subparts G–I of this part, without cost to the customer, as soon as possible after notification of any such violation by an inspector pursuant to § 456.313;

(vii) Submit a copy of all contracts for installation of suggested measures to the covered utility or participating home heating supplier; and

(viii) Agree to participate in good faith in the complaint processing procedures described in § 456.315 when there is a complaint by an eligible customer against such person.

(2) The State Plan shall require that, when supplying suggested measures or parts of suggested measures under the circumstances described by the State Plan pursuant to § 456.305, all suppliers included in the Master Record shall:

(i) Supply measures which meet any applicable standards found in Subparts G or H of this part and carry the program warranty defined in § 456.105(m) for each suggested measure or part of suggested measure which the supplier is listed as supplying; and

(ii) Prominently display, wherever they sell suggested measures or parts of suggested measures, a statement explaining that such measures meet any applicable DOE material standards and carry the program warranty defined § 456.105(m).

(3) The State Plan shall require that, when financing the sale or installation of suggested measures under the circumstances described by the State Plan pursuant to § 456.305, all lenders included in the Master Record shall:

(i) If a periodic bill is provided, follow the procedures for resolving billing error disputes required in § 456.311(b)(3);

(ii) Not take security in real property which is used as the principal residence of the eligible customer, unless the eligible customer acknowledges in writing that he or she is aware of the consequences of default on the loan; and

(iii) Permit a rebate of unearned finance charges if an eligible customer prepays a loan (either voluntarily or as a result of default). The amount of such rebate shall be determined by the actuarial method. Where prepayment is the result of default, the rebate shall be computed from the day of acceleration.

(4) The State Plan may include additional requirements if the Secretary determines that such requirements are fair and nondiscriminatory.

(c) *Lists Distributed to Eligible Customers.* The State Plan shall require that every covered utility and participating home heating supplier provide upon request to every eligible customer, lists of all suppliers, contractors, and lenders included in the Master Record who sell, install or finance suggested measures in their service area or such other reasonable area required by the State Plan.

(1) The State Plan shall require that these lists contain the following information in a fair, open, and nondiscriminatory manner.

(i) The name and address of each such supplier, contractor, and lender; and

(ii) An indication of which suggested measures such supplier, contractor, or lender will supply, install, or finance.

(2) The State Plan may require the lists to indicate which type of a suggested measure a supplier or contractor sells or installs. If the lists include such information for one type of a suggested measure, than it shall include such information for all types of such measure. For example, if the lists indicate who sells wooden storm windows, then they must also indicate who sells aluminum or vinyl storm windows.

(3) The State Plan shall require that these lists include in a clear and conspicuous manner the following information:

(i) A statement that the persons listed have agreed to comply with any applicable DOE standards and State Plan procedures for the sale, installation, or financing of suggested measures under the circumstances as described in the State Plan pursuant to § 456.305;

(ii) A Description of the circumstances under which such standards shall be met and such procedures shall be followed;

(iii) A description of the complaints processing procedures required by

§ 456.315 which explains who may have access to such procedures and how to gain access to such procedures; and

(iv) An invitation to all suppliers, contractors, and lenders not included on the lists to apply for inclusion;

(4) The State Plan shall prohibit any additonal information from appearing on the lists unless the Secretary determines that it is not unfair, deceptive, or anticompetitive.

(5) The State Plan shall contain procedures to ensure that all covered utilities and participating home heating suppliers use the information received pursuant to paragraph (a)(6) of this section (additions to and deletions from the Master Record), when responding to specific requests of eligible customers or when arranging the sale, installation or financing of suggested measures.

(6) The State Plan shall contain procedures to ensure that these lists are updated at least every six months to add or delete the name and address of any person added to or deleted from the Master Record.

**§ 456.313 Post-installation inspection.**

(a) *Mandatory Inspection of All Vent Dampers, Electric Ignition Systems, and Wind Energy Systems.* The State Plan shall provide procedures for performing post-installation inspections of all vent dampers, electrical ignition systems, and wind energy systems installed under the circumstances described in the State Plan pursuant to § 456.305. These procedures shall, at a minimum, assure:

(1) That such inspection occur within one week of the installation;

(2) That the inspector performing these inspections:

(i) Meets the applicable qualfications of § 456.314; and

(ii) Has no financial interest in the contractor who installed the measure unless such contractor is a covered utility or participating home heating supplier;

(3) That such inspection examines compliance with any applicable installation standards found in Subparts G or I of this part; and

(4) That the results of such inspections are reported to:

(i) The customer, as soon as possible;

(ii) The installer, as soon as possible; and

(iii) The Listing Agency, within a reasonable time.

(b) *Random Inspection.* The State Plan shall provide procedures for performing random inspections of the suggested measures installed under the circumstances described in the State Plan pursuant to § 456.305. These procedures shall, at a minimum, assure:

(1) The performance of the following random inspections of suggested measures:

(i) For the first ten insulation installations by each insulation contractor, forty percent of such installations; and

(ii) Twenty percent of all installations of each suggested measure, excluding those installations requiring mandatory inspections described in paragraph (a) of this section but including the insulation installation described in subparagraph (1) of this paragraph. The random inspections required by this subparagraph may be reduced in number at such time as the State demonstrates to the Secretary that a twenty percent random inspection is unnecessary to ensure safe and effective installation of suggested measures under the Program.

(2) That the inspector performing these random inspections:

(i) Meets the applicable qualifications of § 456.314; and

(ii) Has no financial interest in the contractor who installed the measures.

(3) That such inspection examines compliance with any applicable installation standards found in Subparts G or I of this part.

(4) That the results of such inspections are reported within a reasonable time to:

(i) The customer;

(ii) The installer; and

(iii) The Listing Agency.

(c) The State Plan shall identify the person(s) or agency(ies) responsible for administering the procedures for post-installation inspections. Such person(s) or agency(ies) may be the Listing Agency.

**§ 456.314 Qualification procedures for auditors, installers, and inspectors.**

(a) *Auditors of Energy Conservation measures.* The State Plan shall contain Qualification Procedures for auditors of energy conservation measures which shall assure that each such auditor meets the following qualifications:

(1) *Energy Overview.* The auditor shall have an understanding of the current uses of energy, current sources of energy, alternative sources of energy, and the trend of increasing energy demands.

(2) *Basic Principles of Heat Flow.* The auditor shall be familiar with the three types of heat transfer and the effects of temperature and humidity on heat transfer.

(3) *Residential Construction.* The auditor shall have a general understanding of constuction terminology and components.

(4) *Suggested Measures.* The auditor shall:

(i) Be familiar with the different types of each suggested energy conservation measure and with the advantages, disadvantages and applications of each;

(ii) Be familiar with the installation standards in Subpart I;

(ii) Be familiar with the types of heating fuels and systems used in the locality which the auditor will serve; and

(iv) Know how to measure flue gas temperatures and $CO_2$ and how to calculate the steady state efficiency of oil-fired furnaces.

(5) *Energy Conservation Practices.* The auditor shall be familiar with the energy conserving practices defined in § 456.105(e).

(6) *Auditing Skills.* The auditor shall be proficient in the pertinent auditing procedures, as prescribed by the State Plan pursuant to § 456.307, for each suggested measure the auditor will address.

(b) *Auditors of Renewable Resource Measures.* The State Plan shall contain qualification procedures for auditors of renewable resource measures which shall assure that each such auditor meets the criteria of paragraph (a) (1), (2), (3), (4)(iii), (5), and (6) of this section. In addition, the qualification procedures shall ensure that each renewabale resource auditor:

(1) Is familiar with the type of suggested renewable resource measure he or she will address during each audit and with the advantages, disadvantages and application of such measure; and

(2) Is familiar with the Installation Practices in Subpart G of this part.

(c) *Installers and Inspectors of Vent Dampers in Gas-Fired Furnaces.* [Reserved.]

(d) *Installers and Inspectors of Vent Dampers in Oil-Fired Furnaces.* [Reserved.]

(e) *Installers and Inspectors of Electric Ignition Systems in Gas-Fired Furnaces.* [Reserved.]

(f) *Installers and Inspectors of Wind Energy Devices.* [Reserved.]

(g) *Quality Examiner.* The State Plan shall contain qualification procedures for quality examiners who will conduct the random inspections required by § 456.313. These procedures shall ensure that quality examiners are familiar with the installation standards contained in subparts G or I of this part as appropriate, and shall ensure the examiner's ability to examine compliance of the installation of suggested measures with the applicable installation standards.

(h) *Format of Qualifying Procedures.* Each qualification procedure shall consist of either:

(1) Training designed to instruct the individuals in the proper performance of their function(s);

(2) Tests designed to assess and certify the individuals' qualifications to

perform their functions. Such tests may include either written or practical tests as determined necessary to meet the requirements of this section;

(3) A combination of the methods identified in subparagraph (1) or (2) of this paragraph; or

(4) Any other methods which assure that individuals identified in this section meet the appropriate qualifications prescribed in this section.

(i) *Additional Requirements with respect to Qualifying Procedures.* The State Plan shall:

(1) Contain procedures which assure that persons are permitted, in a nondiscriminatory manner, to participate in the qualification procedures and describe how this will be done; and

(2) Identify the timetable for initial implementation of the qualification procedures and for subsequent implementation of such procedures. Such timetable shall, at a minimum, profive for initial implementation no later than ninety (90) days following the approval of the State Plan.

**§ 456.315 complaints processing procedures.**

The State Plan shall contain procedures for resolving complaints which must include the following methods of complaint resolution:

(a) *Conciliation Conference for Customer Complaints.* A conciliation conference shall be made available for the purpose of resolving complaints by eligible customers against persons who sell, install or finance the sale or installation of suggested measures under the circumstances described in the State Plan pursuant to § 456.305.

(1) The procedures described in the State Plan for conciliation conferences shall ensure that:

(i) Participation in the conciliation conference is free of cost and easily accessible to the eligible customer alleging injury;

(ii) Participation in the conciliation conference by the eligible customer alleging injury is voluntary; and

(iii) The conciliation conference is presided over by an impartial conciliator who has no financial interest in any party involved in the complaint or in the outcome of the proceeding.

(2) The State Plan shall identify the person(s) or agency(ies) responsible for administering the procedures for the conciliation conference.

(b) *Redress Proceeding.* A redress proceeding shall be made available to all persons alleging injury arising from an activity carried out under the State Plan or from a violation of the State Plan.

(1) The procedures described in the State Plan for redress proceedings shall ensure that:

(i) The redress proceeding is easily accessible to all persons alleging an injury under the Program or a violation of the State Plan;

(ii) The redress proceeding is available to an eligible customer whether or not the eligible customer has participated in the conciliation conference described in paragraph (a) of this section;

(iii) All persons who have a substantial interest in the outcome of a redress proceeding are given timely and adequate notice of the proceeding and have an opportunity to participate in the proceeding;

(iv) The cost of access to and participation in the redress proceeding is kept at a minimum;

(v) The redress proceeding is held within a reasonable time after the initial complaint has been filed;

(vi) The redress proceeding is held before an impartial deciding official who has no financial interest in any party to the complaint or in the outcome of the proceeding;

(vii) Formal rules of evidence are not required;

(viii) The deciding official delivers a written decision and a brief statement of reasons for coming to the decision within a reasonable time after the date of the proceeding;

(ix) The decision is enforceable under State law; and

(x) The decision and statement of reasons is sent to the Lead Agency within a reasonable time.

(2) The State Plan shall identify the person(s) or agency(ies) responsible for administering the procedures for the redress proceeding. Such person(s) or agency(ies) may be a State court if the requirements of this Subsection are met.

(c) *Civil Action.* A right of action in a State Court shall be made available for persons seeking recovery of damages for an injury arising from an activity carried out under the State Plan or from a violation of a State Plan. The State Plan shall cite the existing or proposed State law which gives a State court or courts jurisdiction over such civil actions.

**§ 456.316 Coordination.**

(a) *Other programs.* The State Plan shall provide procedures to ensure effective coordination between its residential Conservation Service Program as described in the State Plan and all local, State, and Federal energy conservation programs within and affecting the State which shall include, but not be limited to:

(1) Federal Energy Extension Service;

(2) Basic State Energy Conservation Program of the Department of Energy;

(3) Supplemental State Energy Conservation Program of the Department of Energy; and

(4) Weatherization Assistance Program for Low Income Persons.

(b) *Energy Suppliers.* If the State Plan permits coordination of Residential Conservation Service Programs among energy suppliers in the State, then it shall provide procedures describing how such coordination may occur and ensuring that no collusion on prices charged to eligible customers will occur.

(c) *State Regulatory Authority.* If the lead Agency is not the State Regulatory authority, then the State Plan shall describe how the Lead Agency shall coordinate the implementation of the State plan with the State Regulatory Authority.

**§ 456.317 Home heating suppliers.**

(a) *Consideration of Limited Resources.* If a State Plan covers home heating suppliers, it shall, within the terms of the requirements of this Subpart, take into account the limited resources of small home heating suppliers.

(b) *Participation and Withdrawal.* The State Plan shall include a procedure by which the Governor shall allow a home heating supplier to participate in its Residential Conservation Service Program. The State Plan shall also provide for the voluntary withdrawal of participating home heating suppliers from its Residential Conservation Service Program.

(c) *Waiver of Requirements.* The State Plan shall contain a procedure by which the Governor may waive for any participating home heating supplier any requirement of the State Plan, except those listed below, upon a demonstration to the Governor's satisfaction that the resources of such supplier do not enable it to comply with the particular requirement. The requirements which the Governor shall not waive for any home heating supplier who chooses to participate in the program are those established according to:

(1) Section 456.303 (Procedures for Investigating and Enforcing Compliance with the State Plan);

(2) Section 456.305 (Scope of Benefits), in that any benefit to which any eligible customer is entitled by receiving a service from a covered utility must also be available to any eligible customer who receives the same service from a participating home heating supplier;

(3) Section 456.306(c) (Calculation Procedures for the Program Announcement), if the participating home heating supplier provides a Program Announcement to its eligible customers;

(4) Section 456.307(d)(3) (Consistency of Auditing Procedures), if a participating home heating supplier performs energy audits for its eligible customers;

(5) Those sections which prohibit anticompetitive activities or unfair discrimination by covered utilities or participating home heating suppliers, which are:

(i) Sections 456.306(a) (9) and (10) (Information Prohibited from the Program Announcement);

(ii) Section 456.307(b)(3) (Discrimination Among Customers in Providing Energy Audits);

(iii) Section 456.307(f) (Prohibitions in Auditing);

(iv) Section 456.307(g) (Furnace Audits);

(v) Section 456.308(e) (Prohibitions of Discrimination in Arranging Installation);

(vi) Section 456.309(e) (Prohibitions of Discrimination in Arranging Financing);

(vii) Sections 456.312(c) (1)–(4) (Content of Lists).

(6) The following reporting and recordkeeping requirements:

(i) Section 456.318(a)(1);

(ii) Section 456.318(a)(5), except that the Governor may waive § 456.318(a)(5)(vi) concerning the accounting of program costs; and

(iii) Section 456.318(b) (Recordkeeping).

**§ 456.318 Reporting and Recordkeeping.**

(a) *Reporting.* The State Plan shall contain provisions to assure that a report is submitted to the Secretary on July 1, 1981 and annually thereafter through July 1, 1986, which contains the following information for the twelve-month period ending the preceding April 1:

(1) A list of all covered utilities and participating home heating suppliers subject to the State Plan;

(2) A list of all covered utilities and participating home heating suppliers subject to the State Plan engaged in supplying, installing, or financing energy conservation measures pursuant to § 456.503 (Exception for Certain Measures and Small Loans) of these rules, and a description with respect to each utility of the nature of the exempted activity in which it is engaged;

(3) A list of all covered utilities subject to the State Plan engaged in supplying, installing, or financing energy conservation or renewable resource measures pursuant to § 456.504 (Exception for Existing Supply, Installation and financing) and a description with respect to each utility of the nature of the exempted activity in which it is engaged;

(4) A list of all covered utilities subject to the State Plan which are either engaged in supplying, installing, or financing energy conservation or renewable resource measures pursuant to a waiver granted by the Office of Hearings and Appeals under § 456.505 (Waivers), or which are petitioning for such a waiver;

(5) For each covered utility or participating home heating supplier:

(i) The average number of eligible customers;

(ii) The number of Program Announcements distributed to eligible customers;

(iii) A description of the services which the covered utility or participating home heating supplier offers under the State Plan;

(iv) The number of eligible customers who have requested each service and the number of requests the utility or participating home heating supplier has fulfilled, including:

(A) The number of energy audits performed;

(B) The number of installations of each suggested measure arranged by the covered utility of participating home heating supplier and the total cost of such installations;

(C) The number of loans the covered utility or participating home heating supplier has arranged;

(D) The number of customers who are repaying loans as part of their periodic bills, and the average size of such loans;

(E) The number of lists of suppliers, contractors, and lenders which the covered utility or participating home heating supplier has distributed;

(F) The number of installation, if any, of suggested measures which the covered utility or participating home heating supplier supplied, installed, or financed;

(v) The number and function of people assigned to the covered utility's or participating home heating supplier's program, including part-time employees; and

(vi) The cost of providing each service under the Residential Conservation Service Program including separately those costs paid by individual customers for services received and those costs paid by all customers as part of rates for energy.

(6) The number and nature of complaints by eligible customers against suppliers, contractors, and lenders which have been handled through the conciliation conference established under § 456.315(a);

(7) The number of persons seeking redress through the procedures described in § 456.315(b), and the nature of their allegations;

(8) The number of people who are qualified under the procedures required by § 456.314 to perform energy conservation audits, renewable resource audits, audits of furnace equipment, and installation of furnace equipment;

(9) The number of persons added to or removed from the Master Record established according to § 456.312, and the reasons for removal of firms;

(10) The number and findings of post-installation inspections conducted according to § 456.313;

(11) The number and function of State employees assigned to the Residential Conservation Service Program, including part-time employees;

(12) The cost of the Residential Conservation Service Program to the State, including all costs fully or partially paid by eligible customers; and

(13) In the first such annual report, the status of any proposed State or local legislation relevant to the State Plan.

(b) *Recordkeeping.* The State Plan shall contain procedures to assure that the following records are kept for the periods indicated and made available to the Secretary upon request:

(1) The name and address of each eligible customer who requests an energy audit, which shall be kept for five years;

(2) A copy of the data collected during the audit, and a copy of the estimates of costs and savings presented to the customer, which shall be kept for five years;

(3) A copy of all requests by eligible customers for furnance audits which are required by § 456.307(g), which shall be kept for five years;

(4) The name and address of each eligible customer for whom a covered utility or participating home heating supplier arranges installation or financing of a suggested measure, which shall be kept for five years;

(5) A copy of each contract for installation of any suggested measure arranged by a covered utility or participating home heating supplier, which shall be kept for five years;

(6) The amount and cost of fuel purchased each month or other billing period for each eligible customer, which shall be kept for two years; and

(7) The names of the individuals who have met the qualification criteria described in § 456.314. These records shall be:

(i) Updated within a reasonable period of time following each implementation of the qualification procedures, and

(ii) Maintained separately with respect to the records of installers and inspectors of vent dampers, electronic ignition devices and wind energy systems.

**Subpart D—Nonregulated Utility Plans**

**§ 456.401 Scope.**

This subpart identifies the responsibilities of covered nonregulated utilities not subject to a State Plan for the

preparation and submission of Nonregulated Utility Plans, the procedures for approval of Nonregulated Utility Plans by the Secretary, and the minimum requirements for the content of Nonregulated Utility Plans.

**§ 456.402 Coverage.**

This subpart shall apply to all nonregulated covered utilities which are not covered by a State Plan.

**§ 456.403 Initial submission.**

Each utility subject to this subpart shall notify the Secretary, within 60 days after promulgation of these rules, of the person responsible for the preparation of its Nonregulated Utility Plan.

**§456.404 Coordination requirements.**

Each utility subject to this subpart shall, to the extent feasible, coordinate the preparation of its Nonregulated Utility Plan with the preparation of the applicable State Plan for the purpose of minimizing inconsistent provisions between the two plans.

**§ 456.405 Notice, comment, and public hearing.**

Prior to submission of the Nonregulated Utility Plan to the Secretary for approval, the nonregulated utility shall:

(a) *Notice and Comment.* Provide meaningful public notice of the requirement for the nonregulated utility to submit a Nonregulated Utility Plan. To be meaningful, this notice shall, at a minimum:

(1) Appear in newspapers of general circulation published in the nonregulated utility's service area;

(2) Indicate where a copy of the proposed Nonregulated Utility Plan can be obtained and where questions concerning the Plan can be answered;

(3) Indicate the date, time, and location of each public hearing to be held pursuant to § 456.405(b) with at least 30 days notice; and

(4) Invite public comments on the content of the proposed Nonregulated Utility Plan, at least 30 days prior to the final date for receiving such comments.

(b) *Hearing.* Hold at least one public hearing in the nonregulated utility's service area for the purpose of hearing testimony and receiving comments on the content of the proposed Nonregulated Utility Plan.

**§ 456.406 Procedures for submission and approval of Nonregulated Utility Plans.**

(a) *Submission.* Each utility subject to this Subpart shall submit within 180 days of promulgation of these rules a proposed Nonregulated Utility Plan. The time for submission may be extended by the Secretary if:

(1) The nonregulated utility requests an extension at least 10 days prior to the formal deadline; and

(2) Good cause is shown for allowing an extension.

(b) *Approval.* (1) If a proposed Nonregulated Utility Plan meets the criteria of this subpart, the Secretary shall approve it within 90 days of the date the proposed Nonregulated Utility Plan was submitted.

(2) Within 180 days after the approval of the Nonregulated Utility Plan, the nonregulated utility shall provide to the Secretary a statement certifying whether it is in compliance with its Nonregulated Utility Plan.

(c) *Disapproval.* (1) if a Nonregulated Utility Plan does not meet the criteria of this Subpart, the Secretary shall, within 90 days of the date the proposed Nonregulated Utility Plan was submitted, disapprove the proposed Nonregulated Utility Plan and specify in writing the grounds for disapproval.

(2) Within 60 days of the date of disapproval of a proposed Nonregulated Utility Plan, or such longer period as the Secretary may determine pursuant to the criteria of paragraph (a) of this section, the nonregulated utility shall submit another proposed Nonregulated Utility Plan. The procedures of this subpart for submission of the original proposed Nonregulated Utility Plan shall be applicable to the submission of any proposed Nonregulated Utility Plan submitted after initial disapproval, except for the 60 days requirement of this paragraph.

(d) *Amendments.* (1) The nonregulated utility may submit proposed amendments to an approved Nonregulated Utility Plan at any time.

(2) Except in the time in which a proposed plan must be submitted, the procedures of this Subpart for submission of the original Nonregulated Utility Plan shall be applicable to the submission of proposed amendments to an approved Nonregulated Utility Plan.

**§ 456.407 Temporary programs.**

A nonregulated utility may submit a temporary program as defined in § 456.208(a) in accordance with the procedures and criteria of § 456.208. This submittal may be a part of the proposed Nonregulated Utility Plan or a separate submittal.

**§ 456.408 Content of plans.**

(a) *General requirements.* (1) Except as provided in this section, each Nonregulated Utility Plan shall meet all the requirements for State Plans in Subpart C of this part.

(2) Except as otherwise provided in this section, all references in Subpart C of this part to:

(i) Covered utilities shall be deemed to refer to utilities subject to this Subpart;

(ii) A State Plan shall be deemed to refer to a Nonregulated Utility Plan;

(iii) Participating home heating suppliers shall not apply;

(iv) A State (as a governmental entity, other than references to State laws or regulations) or any State Agency of officer shall be deemed to refer to the nonregulated utility submitting the Plan; and

(v) A State (as a geographic area) shall be deemed to refer to the nonregulated utility's service area.

(b) *Program Announcement.* A Nonregulated Utility Plan need not contain a provision comparable to that requred for State Plans in § 456.306(c)(3)(i): *Provided,* That the nonregulated utility shall coordinate with the State Lead Agency to minimize inconsistencies with respect to the estimates of costs and savings contained in Program Announcements distribued by the nonregulated utility and those distributed by utilities subject to the State Plan in the same area.

(c) *Energy Audit.* A Nonregulated Utility Plan need not contain a provision comparable to that required for State Plans in § 456.307(d)(3)(i): *Provided,* That the nonregulated utility shall coordinate with the State Lead Agency to minimize inconsistencies between data used by the nonregulated utility in the audit calculations and the data used in audit calculations by utilities subject to the State Plan in the same area.

(d) *Quality Examiner Financial Interest.* Where a nonregulated utility installs suggested measures, the prohibition in § 456.313(b)(2)(ii) against quality examiners having any financial interest in the installing contractor shall not apply with respect to installations made by the nonregulated utility.

(e) *Complaint Processing Procedures.* The requirements of §§ 456.315(b)(1)(ix) and 456.315(c) are not applicable to Nonregulated Utility Plans.

(f) *Coordination and Home Heating Supplies.* The requirements of §§ 456.316(b) and (c) and 456.317 are not applicable to Nonregulated Utility Plans.

(g) *Reporting Requirements.* The requirements of § 456.318(a)(1)–(4) are not applicable to Nonregulated Utility Plans.

(h) *Utilizing State Plans.* (1) In a State submitting a State Plan, a nonregulated utility may by written understanding with the appropriate State agency incorporate by reference in its Nonregulated Utility Plan those parts of the State Plan required by:

(i) Section 456.306(c);

(ii) Section 456.307(c);
(iii) Section 456.307(d);
(iv) Section 456.312;
(v) Section 456.313(a);
(vi) Section 456.313(b);
(vii) Section 456.314; or
(viii) Section 456.315.

(2) If a Nonregulated Utility Plan incorporates provisions in a State Plan by reference as permitted by paragraph (h)(1) of this Section, all references in those provisions to utilities subject to the State Plan shall be deemed to refer to the nonregulated utility.

(3) If a Nonregulated Utility Plan uses a State produced Master Record, the nonregulated utility may not add or delete contractors, suppliers, or lenders from that Master Record or add or delete contractors, suppliers, or lenders from any list distributed, except in accordance with the State Plan.

### Subpart E—Supply, Installation, and Financing by Utilities

#### § 456.501 Scope and definitions.

(a) This Subpart contains the prohibition against a covered utility's supply, installation, and financing of energy conservation and renewable resource measures. It also specifies the exceptions to this prohibition and the procedures, where applicable, for obtaining those exceptions.

(b) For purposes of this subpart:

(1) A utility "installs" a measure whenever the contract for installation obligates (1) the utility, (2) any company which is owned or controlled by the utility, or (3) any person who has an exclusive contract with the utility to install the measure.

(2) A utility also "installs" a measure when it leases a measure, no matter who makes the actual installation.

(3) A utility "supplies" a measure when it sells a measure at retail to an eligible customer.

(4) A utility "finances" the supply or installation of a measure when the loan contract names as the lender either (1) the utility, (2) any company which is owned or controlled by the utility, or (3) any person who has an exclusive contract or agreement with the utility to make loans for energy conservation or renewable resource measures.

#### § 456.502 Prohibition.

(a) Except as provided in this Subpart, no covered utility may supply, install, or finance the supply or installation of any energy conservation or renewable resource measure.

(b) Notwithstanding §§ 456.503–456.506, no covered utility may supply, install, or finance the supply or installation of any energy conservation or renewable resource measure if the Secretary has determined, after notice and opportunity for public hearing, and after consultation with the Federal Trade Commission, that—

(1) Such supply, installation, or financing is being carried out by such utility at unreasonable rates or on unreasonable terms or conditions, or

(2) Such supply, installation, or financing carried out by such utility has a substantial adverse effect upon competition.

(c) Violations of this section are subject to a civil penalty of not more than $25,000 for each day of violation assessed by order of the Secretary pursuant to Sections 216(h) and 219 of NECPA and § 456.606 of these rules.

#### § 456.503 Exception for certain measures and small loans.

(a) The prohibition in § 456.502(a) shall not apply to the supply, installation, or financing of (1) furnace efficiency modifications, (2) clock thermostats, and (3) devices associated with load management techniques.

(b) The prohibition in § 456.502(a) shall not apply to the financing of the purchase or installation of an energy conservation or renewable resource measure if the principal of such loan does not exceed $300.

#### § 456.504 Exception for existing supply, installation, and financing.

(a) Any supply, installation, or financing of any energy conservation or renewable resource measure that the utility was engaged in on November 9, 1978, shall not be subject to the prohibition in § 456.502(a):

(1) Prior to thirty days after promulgation of these rules,

(2) During such time as applications for determinations with respect to such activity, filed in accordance with § 456.507, are pending, and

(3) Upon a final determination that such energy conservation or renewable resource measure was being supplied, installed, or financed on November 9, 1978 by the utility seeking the determination.

(b) Any supply, installation, or financing of any energy conservation or renewable resource measure which the utility had by November 9, 1978, broadly advertised that it would supply, install, or finance, or with respect to which the utility had by November 9, 1978, completed substantial preparations for supplying, installing, or financing shall not be subject to the prohibition in § 456.502(a):

(1) Prior to thirty days after promulgation of these rules,

(2) During such time as applications for determinations with respect to such activity filed in accordance with § 456.507 are pending.

(3) Upon a final determination that the utility had by November 9, 1978, either broadly advertised its supply, installation, or financing of such measures or had completed substantial preparations for its supplying, installing, or financing of such measures.

#### § 456.505 Waivers.

(a) The Assistant Secretary for Conservation and Solar Applications may, in consultation with the Administrator of the Economic Regulatory Administration, waive any prohibition of § 456.502(a) upon petition by a covered utility pursuant to § 456.507 and a finding that:

(1) The petition, in the case of a regulated utility or a nonregulated utility subject to a State Plan, is supported by the Governor, and

(2) If such waiver were granted:

(i) Fair and reasonable prices and rates of interest would be charged, and

(ii) The otherwise prohibited activities would not involve or result in unfair methods of competition or unfair or deceptive acts or practices.

(b) Before the Assistant Secretary makes the finding described in paragraph (a)(2)(i) of this section, he or she shall consult with those staff members of the Federal Trade commission as the Chairman of the Commission may designate.

#### § 456.506 Exception for supply, installation, and financing authorized by State Law.

(a) The prohibition in § 456.502(a) shall not apply to any supply, installation, or financing of any energy conservation or renewable resource measure:

(1) Which a State law or regulation in effect on November 9, 1978, either required or explicitly permitted a covered utility to engage in; or

(2) Which the Attorney General of the appropriate State certifies to the Secretary was intended by a State law or regulation in effect on November 9, 1978, to be excepted from the prohibition in Section 216 (a) of NEPCA.

(b) A covered utility is exempted from any Federal requirement to include in its Residential Conservation Service Program any supply, installation, or financing of any energy conservation or renewable resource measure in which it is engaged by reason of the exception in paragraph (a) of this section.

#### § 456.507 Procedure for obtaining determinations and waivers.

(a) A utility making application for a determination under § 456.504 shall make its application in accordance with Subpart G of Part 205 of these rules. All such applications shall be filed with the Office of Hearings and Appeals, Department of Energy, Washington, D.C. 20461. All such applications shall contain all information

necessary for the determination required by § 456.504.

(b) A utility making a petition for a waiver under § 456.505 shall file such petition clearly labelled as such with the Assistant Secretary for Conservation and Solar Applications, Department of Energy, 20 Massachusetts Avenue, N.W., Washington, D.C. 20545. All such petitions shall contain all information necessary for the findings required by § 456.505.

(c) In addition to any other requirement that may be applicable, any utility making an application or petition under this section shall give direct notice to the Governor, State Energy Office, and State Regulatory Authority of any State in which such exception or waiver would be applicable, informing them that they may within 10 days submit comments on the application or petition to the appropriate office of the Department of Energy. The application or petition filed with the Office of Hearings and Appeals or the Assistant Secretary for Conservation and Solar Applications shall include a certification that the applicant or petitioner has complied with the requirements of this subsection.

### Subpart F—Federal Standby Authority and Enforcement Provisions

#### § 456.601 Scope.

This subpart specifies the procedures to be followed to ensure that eligible customers receive the services of the Residential Conservation Service Program when a State or nonregulated utility does not submit an acceptable Residential Conservation Service Plan or fails to implement adequately an approved plan. These procedures are required to be implemented by the Secretary pursuant to the provisions of section 219 of NECPA. Section 456.602 specifies the conditions under which the Secretary shall invoke standby authority for regulated utilities and nonregulated utilities. Sections 456.603 and 456.604 specify the content of the Federal plans for States and nonregulated utilities, respectively. Section 456.605 specifies the procedures followed by the Secretary if a public utility fails to comply with a Federal standby order issued pursuant to §§ 456.603 or 456.604. Section 456.606 specifies the civil penalties which the Secretary may assess and the enforcement provisions.

#### § 456.602 Conditions under which standby authority shall be invoked.

The Secretary shall invoke standby authority if he determines:

(a) That a State fails to submit a Residential Conservation Service Plan meeting the requirements of Subparts B and C within 270 days after final promulgation of these rules or within such additional period as the Secretary allows pursuant to § 456.206(b) or (d);

(b) That a nonregulated utility fails to submit a Residential Conservation Service Plan meeting the requirements of Subpart D within 270 days after final promulgation of these rules or within such additional period as the Secretary allows pursuant to § 456.406(a) or (c);

(c) After notice and opportunity for a public hearing, that an approved State plan is not being adequately implemented in a State;

(d) After notice and opportunity for a public hearing, that an approved plan is not being adequately implemented by a nonregulated utility.

#### § 456.603 Standby authority in lieu of State plans.

When the Secretary determines that one of the conditions specified in § 456.602(a) or (c) exists:

(a) The Secretary shall promulgate a Residential Conservation Service Plan which meets the requirements of Subparts B and C of this part and which is applicable to each covered regulated utility in the State;

(b) The Secretary shall, by order, require each covered regulated utility in the State to carry out a Residential Conservation Service Program, which meets the requirements of the plan promulgated pursuant to paragraph (a) of this section, within 90 days of the issuance of the order; and

(c) If the State had an approved plan which included nonregulated utilities, the Secretary shall take the actions described in §§ 456.604(a) and (b).

#### § 456.604 Standby authority for nonregulated utilities.

When the Secretary determines that one of the conditions specified in § 456.602(b) or (d) exists:

(a) The Secretary shall, by order, require the covered nonregulated utility to promulgate a plan which meets the requirements of Subpart D of this part; and

(b) The Secretary shall, by order, require such nonregulated utility to carry out a Residential Conservation Service Program, which meets the requirements of the plan promulgated pursuant to paragraph (a) of this section, within 90 days of the issuance of the order.

#### § 456.605 Failure to comply with orders.

If the Secretary determines that any covered utility to which an order has been issued pursuant to §§ 456.603(b), 456.604(a), or § 456.604(b) has failed to comply with such order, the Secretary may file a petition in the appropriate United States district court to enjoin such utility from violating the order.

#### § 456.606 Enforcement provisions.

(a) Any covered utility which violates any requirement of a plan promulgated under §§ 456.603(a) or 456.604(a), or which fails to comply with an order under §§ 456.603(b), 456.604(a), or § 456.604(b) within 90 days from the issuance of such order, or which violates the prohibition in § 456.502 concerning supply, installation, or financing by covered utilities, shall be subject to a civil penalty of not more than $25,000 for each violation.

(b) Each day that such violation continues shall be considered a separate violation.

(c) A civil penalty under this section shall be assessed by an order of the Secretary.

(d) Before issuing an order assessing a civil penalty against any person under this section, the Secretary shall provide to such person notice of the proposed penalty. The notice of proposed penalty shall inform the person of the opportunity to make an election, in writing, within 30 days after receipt of the notice. The election involves deciding whether to have the procedures of paragraph (f) of this section apply, in lieu of the procedures in paragraph (e) of this section, with respect to the assessment of a civil penalty.

(e) (1) Unless the election described in paragraph (d) of this section is made within 30 calendar days after receipt of the notice given under paragraph (d) of this section, the Secretary shall assess the penalty, by order, after a determination of violation has been made on the record. Such determination of violation shall be made after an opportunity has been afforded for an agency hearing pursuant to Section 554 of Title 5, United States Code, before an administrative law judge appointed under Section 3105 of Title 5. The assessment order shall include the administrative law judge's findings and the basis for such assessment.

(2) Any person against whom a civil penalty is assessed under this subsection may, within 60 calendar days after the date of the order of the Secretary assessing the penalty, institute an action in the United States court of appeals for the appropriate judicial circuit for judicial review of such order in accordance with Chapter 7 of Title 5, United States Code. The court shall have jurisdiction to enter a judgment affirming, modifying, or setting aside, in whole or in part, the order of the Secretary, or the court may remand the proceeding to the Secretary for such further action as the court may direct.

(f) (1) In any case where the procedures of this subsection have been elected, as described in paragraph (d)

of this section, the Secretary shall assess such penalty by order. The order shall be made not later than 60 calendar days after the alleged violator's date of receipt of notice of the proposed penalty under paragraph (d) of this section.

(2) If the civil penalty assessed by order under subparagraph (1) of this paragraph has not been paid within 60 calendar days after the assessment order was made, the Secretary shall institute an action in the appropriate district court of the United States for an order affirming the assessment of the civil penalty. The court shall have authority to review de novo the law and the facts involved, and shall have jurisdiction to enter a judgment enforcing, modifying, and enforcing as so modified, or setting aside in whole or in part, such assessment.

(3) Any election to have this Subsection apply may not be revoked, except with the consent of the Secretary.

(g) If any person fails to pay an assessment of a civil penalty after it has become a final and unappealable order under paragraph (e) of this section, or after the appropriate district court has entered final judgment in favor of the Secretary under paragraph (f) of this section, the Secretary shall recover the amount of such penalty in any appropriate district court of the United States. In such action, the validity and appropriateness of the respective final order or judgment imposing the civil penalty shall not be subject to review.

(h) Notwithstanding the provisions of Title 28, United States Code, or of Section 502 of the Department of Energy Organization Act, the Secretary shall be represented by the General Counsel of the Department of Energy (or any attorney or attorneys within the Department of Energy designated by the Secretary) who shall supervise, conduct, and argue any civil litigation to which this section applies (including any related collection action) in a court of the United States or in any other court, except the Supreme Court. However, the Secretary or the General Counsel shall consult with the Attorney General concerning such litigation and the Attorney General shall provide, on request, such assistance in the conduct of such litigation as may be appropriate.

### Subpart G—Renewable Resource Installation and Materials Standards

#### § 456.701 Scope.

This subpart contains both the installation and materials standards with respect to renewable resource measures. Not all renewable resource measures have installation or materials standards under these rules. Those measures not addressed in this Subpart either have been determined not to require Federal standards or have not yet been determined whether or not they require Federal standards.

#### § 456.702 Solar Domestic Hot Water and Active Solar Space Heating Systems.

(a) Solar Domestic Hot Water Systems, other than Thermosiphon Hot Water Heaters, and Active Solar Space Heating Systems shall be constructed and installed in compliance with the *HUD Intermediate Minimum Property Standards Supplement*, Solar Heating and Domestic Hot Water Systems, 4930.2, 1977 Edition, U.S. Department of Housing and Urban Development.

(b) Any reference in the HUD Intermediate Minimum Property Standards Supplement to exceptions or alternatives that may be approved by HUD with respect to the standards therein shall not apply under this section.

#### § 456.703 Thermosiphon Hot Water Heaters. [Reserved.]

#### § 456.704 Passive Solar Space Heating and Cooling Systems. [Reserved.]

#### § 456.705 Swimming Pool Heaters. [Reserved.]

#### § 456.706 Wind Systems.

(a) *Wind System Location.* (1) A Wind System shall be located a minimum horizontal distance of 1½ tower lengths from an occupied structure (other than one which supports the wind equipment).

(2) A Wind System shall be located a minimum distance of 1½ tower lengths from any property line, or a right-of-way for electrical transmission or distribution lines.

(3) Wind System components shall be accessible for cleaning, adjusting, servicing, examination, repair or replacement without trespassing on adjoining property.

(b) *Requirements for Wind Systems.* A Wind System shall:

(1) Be omni-directional in response to the wind direction, or face a quadrant where 60 percent of the wind energy is available at the site;

(2) Be self-starting by the wind or have an automatic starting system.

(3) Have at least two overspeed control methods, one automatic, to protect the machine from overspeed failure.

(4) Have a rated survival wind speed equal to, or greater than, the highest wind recorded during the last three years at the nearest official weather station having such records.

(5) Upon installation be inspected by the manufacturer or his designated representative who shall sign a certificate that the system is correctly installed, which certificate shall be given to the eligible customer.

(6) Bear an identification plate stating the voltage of the system and such other information as may be required by the State Plan, which plate shall be legible from the ground.

### Subpart H—Energy Conservation Material Standards

#### § 456.801 Purpose and Applicability

This subpart identifies and describes standards for products and materials specified as energy conservation measures. These standards apply to energy conservation measures, which when they are suggested measures, are supplied or installed under the circumstances described in the State Plan pursuant to § 456.305.

#### § 456.802 Definitions.

(a) "ASTM" means American Society for Testing and Materials.

(b) "ASTM C 177" means ASTM Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Guarded Hot Plate Standard Test Method.

(c) "ASTM C236" means ASTM Standard Test Method for Thermal Conductance and Transmittance of Built-up Sections by Means of the Guarded Hot Box.

(d) "ASTM C 518" means ASTM Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter.

(e) "ASTM E 84" means ASTM Standard Test Method for Surface Burning Characteristics of Building Materials.

(f) "ASTM E 96" means ASTM Standard Test Method for Water Vapor Transmission of Materials in Sheet Form.

(g) "Critical Radiant Flux" means the levels of incident radiant heat energy on the insulation below which flames will cease to propagate.

(h) "Smoldering Combustion" means the combustion of solid materials without the accompaniment of flame.

(i) "Thermal Resistance" means resistance to the flow of heat.

#### § 456.803 Standards for Loose-Fill Cellulosic or Wood Fiber Insulation.

(a) *Scope.* This section applies to loose-fill cellulosic or wood fiber insulation.

(b) *Definitions.* (1) "Loose-fill cellulosic or wood fiber insulation" means insulation composed of cellulosic or wood fibers, or any combination thereof, suitable for pneumatic or poured application.

(2) "MIL-STD-810, Method 508" means Military Standard Test Method for Fungi Resistance.

(c) *Phsical Requirements.*—(1) *Thermal resistance.* Loose-fill cellulosic or wood fiber insulation shall have a thermal resistance (R-value) of not less than 3.0 $ft^2$-hr °F/Btu per inch thickness. This shall be verified by

testing in accordance with the test method described in Subsection (d)(2). Standard thicknesses for loose-fill cellulosic or wood fiber insulation shall be 1 inch, 3.5 inches, and 6 inches. The R-value for any given sample of loose-fill cellulosic or wood fiber insulation shall not be more than 5 percent below the arithmetic average of the R-values of the specimens tested. This shall be verified by testing in accordance with the test method described in paragraph (d)(2) of this section.

(2) *Fire safety.*—(i) *Critical radiant flux.* The critical radiant flux of loose-fill cellulosic or wood fiber insulation shall not be less than 0.12 W/cm² for each of the three specimens when tested in accordance with the test described in paragraph (d)(3) of this section.

(ii) *Smoldering combustion.* Loose-fill cellulosic or wood fiber insulation shall not flame or show a weight loss greater than 15 percent of the initial weight, for each of the three specimens, when tested in accordance with the test procedure described in paragraph (d)(4) of this section.

(iii) *Flame Resistance Permanency.* [Reserved]

(3) *Vermin-resistance.* Loose-fill cellulosic or wood fiber insulation shall be chemically treated to resist vermin where starch would be found present in the insulation by testing in accordance with the test method described in paragraph (d)(5) of this section.

(4) *Moisture adsorption.* The percent moisture gained in loose-fill cellulosic or wood fiber insulation from exposure to humidity shall be no more than 7 percent by weight when tested in accordance with the test method described in paragraph (d)(6) of this section.

(5) *Odor emission.* Loose-fill cellulosic or wood fiber insulation shall not have a detectable odor which would be found objectionable by testing in accordance with the test method described in paragraph (d)(7) of this section.

(6) *Corrosiveness.* Loose-fill cellulosic or wood fiber insulation shall be judged noncorrosive when tested in accordance with the test method described in paragraph (d)(8) of this section.

(7) *Fungi resistance.* Loose-fill cellulosic or wood fiber insulation shall show no more fungal growth than the control material would show by testing in accordance with the test method described in paragraph (d)(9) of this section.

(8) *Marking.* Each bag of insulation shall be marked with the following information:

(i) Name of Manufacturer.

(ii) Recommended method of application (blowing or pouring).

(iii) Minimum net weight of insulation.

(iv) Table I filled in to show manufacturer's recommended insulation thickness and maximum coverage per bag for specified thermal resistance value.

Where the insulation is intended for application by either blowing or pouring, the bag shall have a separate coverage chart for each type of application.

## TABLE I. COVERAGE CHART

| To Obtain Thermal Resistance* (R-Value) of | Minimum Number of Bags per 1000 Sq.Ft. (MSF) | Installed Insulation Should Not Be Less Than: | Maximum Sq.Ft. Coverage per Bag | The weight per Sq.Ft. of Installed Insulation Should Be Not Less Than** |
|---|---|---|---|---|
| ATTIC | | | | |
| R-40 | bags/MSF | _____ inches thick | _____ sq. ft. | _____ lbs/sq.ft. |
| R-32 | bags/MSF | _____ inches thick | _____ sq. ft. | _____ lbs/sq.ft. |
| R-24 | bags/MSF | _____ inches thick | _____ sq. ft. | _____ lbs/sq.ft. |
| R-19 | bags/MSF | _____ inches thick | _____ sq. ft. | _____ lbs/sq.ft. |
| R-13 | bags/MSF | _____ inches thick | _____ sq. ft. | _____ lbs/sq.ft. |
| SIDEWALLS | | | | |
| R-__ | bags/MSF | 2 inches thick (nominal) | _____ sq. ft. | _____ lbs/sq.ft. |
| R-__ | bags/MSF | 4 inches thick (nominal) | _____ sq. ft. | _____ lbs/sq.ft. |
| R-__ | bags/MSF | 6 inches thick (nominal) | _____ sq. ft. | _____ lbs/sq.ft. |

* *At 75°F Mean Temperature*

** *Based on settled density as determined in (d)(1)*

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(v) The following warning: "Recessed lights and certain electrical devices require clearances from insulation material. Do not install within three inches of these devices."

(d) *Test Methods*—(1) *Test method for measuring settled density.*—(i) *Apparatus.* (A) An insulation specimen container constructed of glass with a flat botoom (approximate diameter of 15.5 cm (5.9 in)), straight sides (without a flared lip or spout) and a total volume of 3.5 to 5 liters (213.6 to 305.1 cu. in).

(B) A flat disk with a total weight of 75±5 g (2.65±0.18 oz) and of a suitable diameter to fit loosely into the specimen container.

(C) A balance of 2 Kg (4.4 lbs) capacity accurate at least to 0.2 g (0.007 oz).

(D) Blower apparatus, two units (supply and overflow) meeting the following specifications: (The Commission staff has found that a Brewer Electric Manufacturing Co., Model 98805 blower is suitable for this purpose, although other blowers may be suitable.)

(*1*) Each blower apparatus shall be capable of blowing an average of 272.2 Kg (600 lbs.) of insulation per hour.

(*2*) Each blower apparatus shall have a nominal air flow of 2.1 cubic meters/min. (75 $ft^3$/min.).

(*3*) Each blower apparatus shall have a nominal motor speed of 16,450 revolutions per minute at 115 VAC.

(E) A shaker unit capable of shaking 4.5 Kg (10 lbs) of weight with a vertical motion of 0.5 g Root Mean Square (RMS) acceleration at an approximate frequency of 9 Hertz (Hz) and displacement of approximately .25 cm (0.1 in) peak to peak. (The Commission staff has found that a Tyler Industries, Portable Sieve Shaker Model Rx-24 is suitable for this purpose, although other shakers may be suitable.

(F) Fill chamber—45.7 cm (18 in) high x 38.1 cm (15 in) wide x 38.1 cm (15 in) deep (see Figure 1 for details).

(G) A cyclone receiver—see Figure 2 for complete details.

(H) Various lengths of nominally 2-inch diameter hose (see Figure 1 for details), as follows:

(*1*) A supply source hose, 274.3±5.1 cm (9 ft±2 in)

(*2*) A cyclone receiver hose, 182.9±5.1 cm (6 ft±2 in)

(*3*) A fill chamber exit hose, 91.4±5.1 cm (3 ft±2 in)

(*4*) An overflow exhaust hose, length as needed.

(I) Blower Control(s) capable of operating the two blowers at 40 volts RMS. As an example, a variac for each of the two blowers with sufficient rating to operate at 40 volts and 12 amperes RMS would be acceptable.

(J) An insulation holding box to hold a sufficient quantity of insulation to fill the speciment container four times.

(ii) *Conditioning.* Specimens shall be conditioned to equilibrium at 21±5°C (69.8±9°F) and 50±5% relative humidity. A less than 1% change in net weight of the specimen in two consecutive weighings with two hours between each weighting constitutes equilibrium.

(iii) *Test Specimen Preparation.*—(A) *Pneumatic Applications.* (*1*) If ambient laboratory conditions are different from those specified, test the speciment within 10 minutes after it has been conditioned.

(*2*) Pour the conditioned insulation into the holding box (Apparatus #10) in sufficient quantity to fill the specimen container (Apparatus #1) four times. Manually break up any large clumps of material that might cause feeding problems.

(B) *Pouring Applications.* (*1*) If ambient laboratory conditions are different from those specified in the conditioning section, test the specimen within one hour after it has been conditioned.

(*2*) Pour loose fill insulation into a simulated attic space until fill. The attic space shall be formed by two (2 x 6) joists placed 40.6 cm (16 in) on center with 1.27 cm (½ in) plywood nailed to the ends and bottom. Fluff the material with a 50.8 cm (20 in) wide garden rake, applying a series of small amplitude strokes while moving the rake slowly along the joist. Repeat the fluffing process six times.

(iv) *Procedure*—(A) *Procedure for Pneumatic Applications.* (*1*) The apparatus shall be set up as shown in Figure 1 or as described in subsection (d)(1)(i) *Apparatus.* Connect one end of the supply source hose (Apparatus H(*1*)) to the intake of the supply blower (Apparatus D). The other end will be used to pick up insulation from the holding box (Apparatus J). Connect one end of the cyclone receiver hose (Apparatus H(*2*) to the outlet of the supply blower and the other end to the cyclone reveiver (Apparatus G). Connect one end of fill chamber exit hose (Apparatus H(*3*) to the intake of the overflow blower (Apparatus D) and the other end to the fill chamber (Apparatus F). Connect one end of the variable length overflow exhuast hose (Apparatus H(*4*) to the outlet of the overflow blower. The other end should be conveniently placed to reduce insulation dust in the test area.

(*2*) Weigh the empty insulation specimen container and record its weight.

(*3*) Place the empty insulation specimen container in the fill chamber (Apparatus F) centered under the cyclone receiver (Apparatus G), and close the front cover.

(*4*) Adjust the blower control(s) (Apparatus I) such that the supply and overflow blowers will operate at a no load voltage of 40 volts RMS.

(*5*) Turn on the blowers simultaneously and proceed to fill the container by picking up material from the box using the supply source hose.

(*6*) The container may fill unevenly, *i.e.*, a void may tend to form off center in the container. If this occurs, stop the blowing process and rotate the container 180 degrees and continue the blowing process until the container just begins to overflow. If, for any reason, the filling process is interrupted more than the one time allowed to rotate the container, begin the process again.

(*7*) Gently screed the excess material using a straight edge so as to leave a uniform surface of the insulation flush with the top of the container.

(*8*) Weigh the filled and leveled container and record the weight. Take care not to bump or jar the container so as not to introduce any extraneous settling of the insulation.

(*9*) Cover the container to prevent spilling and secure the container to the shaker. Operate the shaker for a period of 5 minutes±15 seconds.

(*10*) Remove the container from the shaker and uncover, taking care not to bump or jar it. Lower the disk very slowly into the container until it starts to contact the insulation. At this point, release the disk and allow it to settle onto the insulation under its own weight.

(*11*) Measure the volume of the space occupied by the settled insulation using the bottom edge of the disk as the upper datum point. If the disk is not level, measure the high and low points of the bottom of the disk and average the readings and use this as the height measurement in calculating the volume ($V_s$). This settled insulation volume and insulation weight (w) shall be used to calculate the settled density.

(*12*) Repeat this procedure (1 through 11) using another specimen of the insulation until four settled densities are obtained for a given material. Then average these figures to arrive at a final settled density.

(B) *Procedures for Pouring Applications.* (*1*) Weigh the empty insulation specimen container and record its weight.

(*2*) Using a shovel remove insulation from the simulated attic space and place it into the specimen container until the container just begins to overflow.

(*3*) Follow steps 7 through 11 as specified under Subsection (d)(1)(iv)(A) *Procedure for Pneumatic Applications.*

(4) Repeat this procedure (1 through 3) using another specimen of the insulation until four settled densities are obtained for a given material. Then average these figures to arrive at a final settled density.

(C) *Calculations.* Calculate the settled density of each specimen using the following formula:

Settled Density in $Kg/m^3 = W/V_s$ where

W=combined weight of the container and insulation in grams, minus the weight of the container in grams.

$V_s$=volume of insulation in liters after shaking.

(2) *Test method for thermal resistance.* (i) Perform all testing at a mean temperature of 23.9C (75° F)

(ii) Prepare the insulation to be tested by following the test method for settled density at paragraph (d)(1) of this section.

(iii) Determine the thermal conductance of four samples in accordance with either ASTM C 177, C 518 or C 236. In case of a question, ASTM C 177 shall be used to determine the thermal conductance of the standard reference material used to calibrate the C 518 or C 236 apparatus.

(iv) Calculate the thermal resistance of each sample by taking the reciprocal of each sample's thermal conductance.

(v) Calculate the arithmetic average of the R-values of the four samples. This arithmetic average is the thermal resistance of the loose-fill cellulosic insulation which has been tested.

(3) *Test procedures for critical radiant flux.* Critical radiant flux shall be determined in accordance with the following test procedure; Method of test for critical radiant flux of exposed attic floor insulation using a radiant heat energy source. Prepare the insulation to be tested by following the test method for settled density at paragraph (d)(1) of this section.

(i) *Apparatus.* Test Chamber (Figure 3). An air-gas fueled radiant heat energy panel or equivalent panel inclined at 30° above and directed at a horizontally-mounted attic floor insulation specimen. The radiant panel generates a radiant energy flux distribution ranging along the 100-cm length of the test specimen from a nominal maximum of 1.0 $w/cm^2$ to a minimum of 0.1 $w/cm^2$. The test is initiated by open flame ignition from a pilot burner. The distance burned to flame-out is converted to $w/cm^2$ from the flux profile graph (Figure 10) and reported as critical radiant flux, $w/cm^2$.

(ii) *Construction and instrumentation of the radiant panel test chamber.* The radiant panel test chamber shall be constructed and instrumented as follows:

(A) The radiant panel test chamber, Figures 5 and 6, shall consist of an enclosure 140 cm (55 inches) long by 50 cm (19½ inches) deep by 71 cm (28 inches) above the test specimen. The sides, ends, and top shall be of 1.3 cm (½ inch) calcium silicate board, such as Marinite I, 0.74 $g/cm^3$ (46 $lb/ft^3$) nominal density, with a thermal conductivity at 177° C (350° F) of 1.11 cal (g)/hr $cm^2$ deg C per cm [0.89 Btu/(hr) ($ft^2$) (deg F per in)]. One side shall be provided with an approximately 10 cm x 110 cm (4 x 44 inches) draft tight fire resistant glass window so that the entire length of the test specimen may be observed from outside the fire test chamber. On the same side and below the observation window is a door which, when open, allows the specimen platform to be moved out for mounting or removal of test specimens. A draft tight, fire resistant observation window may be installed at the low flux end of the chamber.

(B) The bottom of the test chamber shall consist of a sliding steel platform which has provisions for rigidly securing the test specimen holder in a fixed and level position. The free, or air access, area around the platform shall be in the range of 1935–3225 $cm^2$ (300–500 square inches). The top of the chamber shall have an exhaust stack with interior dimensions of 10.2 cm (4 inches) wide by 38 cm (15 inches) deep by 30 cm (12 inches) high at the opposite end of the chamber from the radiant energy source. The radiant heat energy source shall be a panel of porous refractory material mounted in a cast iron frame, with a radiation surface of 30.5 x 45.7 cm (12 by 18 inches). The panel fuel system shall consist of a venturi-type or equivalent aspirator for mixing gas and air at approximately atmospheric pressure, a clean dry air supply capable of providing 28.3 NTP (Normal Temperature and Pressure) $m^3$ per hr (1000 standard cubic feet per hour) at 7.6 cm (3.0 inches) of water, and suitable instrumentation for monitoring and controlling the flow of fuel to the panel.

(C) The radiant heat energy panel shall be mounted in the chamber at 30° to the horizontal specimen plane. The horizontal distance from the 0 mark on the specimen fixture to the bottom edge (projected) of the radiating surface of the panel is 8.9 cm (3½ inches). The panel to specimen vertical distance is 14 cm (5½ inches) (see Figure 5). The angle and dimensions given above are critical in order to obtain the required radiant flux. The radiation pyrometer for standardizing the thermal output of the panel shall be suitable for viewing a circular area 25.4 cm (10 inches) in diameter at a range of about 1.37 m (54 inches). It shall be calibrated over the black body temperature range of 490–510° C (914–950° F) in accordance with the procedure described in Subsection (d)(3)(viii). A high impedance voltmeter with a suitable millivolt range shall be used to monitor the output of the radiation pyrometer described. The dummy holder (see Figure 7), shall be constructed from heat-resistant stainless steel (AISI Type 300 (UNA-N08330)) or equivalent, thickness 0.198 cm (0.078 inches), having overall dimension of 114 cm (45 inches) by 32 cm (12¾ inches) with a specimen opening of 20 cm (7.9 inches) by 100 cm (39.4 inches). Six slots are cut in the flange on either side of the holder to reduce warping. The holder is fastened to the platform with two stud bolts at each end.

(D) The specimen tray (see Figure 8) shall be contructed from heat-resistant stainless stell (AISI Type 300 (UNA-N08330)) or equivalent, thickness 0.198 cm (0.078 inches), having overall dimensions of 110 cm (43.3 inches) by 27.3 cm (10.8 inches). The depth of the tray is 5 cm (2 inches). The flanges of the specimen tray are drilled to accommodate two stud bolts at each end: the bottom surface of the flange is 2.1 cm (0.83 inches) below the top edge of the specimen tray.

(E) The pilot burner, used to ignite the specimen shall be a propane venturi torch with an axially symmetric burner tip having a propane supply tube with an orifice diameter of 0.0076 cm (0.003 inches). In operation, the propane flow is adjusted to give a pencial flame blue inner cone length of 1.3 cm (½ inch). The pilot burner is positioned so that the flame generated will impinge on the centerline of the specimen at the 0 distance burned point at right angles to the specimen length (see Figures 5 and 6). The burner shall be capable of being swung out of the ignition position so that the flame is horizontal and at least 5 cm (2 inches) above the specimen plane.

(F) Two 3.2 mm (⅛ inch) diameter stainless steel sheathed, grounded junction chromel alumel thermcouples are located in the flooring radiant panel test chamber (see figures 5 and 6). Thermocouples shall be kept clean to insure accuracy of readout. The chamber thermocouple is located in the longitudinal central vertical plane of the chamber 2.5 cm (1 in) down from the top and 10 cm (4 in) back from the inside of the exhaust stack. The exhaust stack thermocouple is centrally located 15.2 cm (6 inches) from the top. A temperature indicating device with a range of 100–500° C (212–932° F) may be used to determine the chamber temperatures prior to a test.

(G) An exhaust duct with a capacity of 28.3–85 NTP $m^3$ per minute (1000–3000 SCFM) decoupled from the chamber stack by at least 7.6 cm (3

inches) on all sides and with an effective area of the canopy slightly larger than the plane area of the chamber with the specimen platform in the out position shall be used to remove combustion products from the chamber. With the panel turned on and dummy specimen in place, there shall be no measurable difference in air flow through the chamber stack with the exhaust on or off.

(H) The dummy specimen which is used in the flux profile determination shall be made of 1.9 cm (¾ inch) inorganic 0.74 g/cm³ (46 lbs/ft³) nominal density calcium silicate board, such as Marinite I (see Figure 7). It is 25 cm (10 inches) wide by 107 cm (42 inches) long with 2.7 cm (1-1/16 inches) diameter holes centered on and along the centerline at the 10, 20, 30, 40, 50, 60, 70, 80, 90 cm locations, measured from the maximum flux end of the specimen. The total heat flux transducer used to determine the flux profile of the chamber in conjunction with the dummy specimen should be of the Schmidt-Boelter type, having a range of 0–1.5 watts/cm² (0–1.32 Btu/ft² s), and shall be calibrated over the operating flux level range of 0.10 to 1.5 watts/cm² in accordance with the procedure outlined in paragraph (d)(3)(viii) of this section. The incoming cooling water flowing through the instrument shall be 15–25° C (59–77° F). A high impedance voltmeter with a resolution of at least 0.01 m.v. shall be used to measure the output of the total heat flux transducer during the flux profile determination. A timer shall be used for measuring preheat and pilot contact time.

(iii) *Safety procedures.* The possibility of a gas-air fuel explosion in the test chamber should be recognized. Suitable safeguards consistent with sound engineering practice should be installed in the panel fuel supply system. These may include one or more of the following (A) a gas feed cut-off activated when the air supply fails, (B) a fire sensor directed at the panel surface that stops fuel flow when the panel flame goes out, (C) a commercial gas water heater or gas-fired furnace pilot burner control thermostatic shut-off which is activated when the gas supply fails or other suitable and approved device. Manual reset is considered a desirable feature of any safeguard system used. In view of the potential hazard from products of combustion, the exhaust system must be so designed and operated that the laboratory environment is protected from smoke and gas. The operator should be instructed to minimize his exposure to combustion products by following sound safety practice, e.g., insure exhaust system is working properly, wear appropriate clothing including gloves, and so forth.

(iv) *Test specimens.* Test specimens intended for blowing applications shall be blown into the tray. The tray shall be filled by blowing the insulation through a commercial blower (Note 1) using 30.48 m (100 ft.) of nominal 2 inch flexible blower hose. The tray shall be located at the same level as the blowing machine on a level floor. When blowing, the hose shall be pointed 10 ± 1 degrees upward. The bottom end of the hose orifice shall be 17.7 cm (7 inches) above the floor surface. When the insulation is blowing at a steady rate, start filling the tray so that the main stream of the material is falling over the rear wall; slowly move backward maintaining the height and direction of the hose as specified. Continue filling the tray at an even rate until the material falls over the front wall of the tray. Screed the insulation to the top of the tray, taking care not to compact the insulation or leave large voids in the surface of the material. Insulation intended for pouring applications shall be poured into the tray until the tray is overfilled and then carefully screeded to the top of the tray taking care not to compact the insulation or leave large voids in the surface of the material. Insulation suitable for both pouring and blowing applications may be subjected to the entire test procedure for each of the intended applications. Three specimens per sample shall be tested.

NOTE 1—Breuer Electric Manufacturing Company, Model 98805 has been found to be suitable for this purpose.

(v) *Radiant heat energy flux profile standardization.* In a continuing program of tests, the flux profile shall be determined not less than once a week. Where the time interval between tests is greater than one week, the flux profile shall be determined at the start of the test series.

(A) Mount the dummy specimen in the mounting frame and attach the assembly to the sliding platform. With the sliding platform out of the chamber, ignite the radiant panel. Allow the unit to heat for 1 hour. The pilot burner is off during this determination. Adjust the fuel mixture to give an air-rich flame. Make fuel flow settings to bring the panel to an apparent black body temperature as measured by the radiation pyrometer, of about 500° C (932° F), and the chamber temperature to about 180° C (356° F). When equilibrium has been established, move the specimen platform into the chamber. Allow 0.5 hours for the closed chamber to equilibrate. Measure the radiant heat energy flux level at the 40 cm point with the total flux meter instrumentation. This is done by inserting the flux meter in the opening so that its detecting plane is 0.16–0.32 cm (1/16–⅛ inch) above and parallel to the plane of the dummy specimen and reading its output after 30 ± 10 seconds. If the level is within the limits specified, the flux profile determination is started. If it is not, make the necessary adjustments in panel fuel flow. A suggested flux profile data log format is shown in Figure D.

(B) The test shall be run under chamber operating conditions which give a flux profile as shown in Figure 10. The radiant heat energy incident on the dummy specimen shall be between 0.87 and 0.95 W/cm² (0.77 and 0.83 Btu/ft² sec) at the 20 cm point, between 0.48 and 0.52 W/cm² (0.42 and 0.46 Btu/ft² sec) at the 40 cm point, and between 0.22 and 0.26 W/cm² (0.19 and 0.23 Btu/ft² sec) at the 60 cm point. Insert the flux meter in the 10 cm opening following the procedure given above. Read the millivolt output at 30 ± 10 seconds and proceed to the 20 cm point. Repeat the 10 cm procedure. The 30 to 90 cm flux levels are determined in the same manner. Following the 90 cm measurement, make a check reading at 40 cm. If this is within the limits set forth, the test chamber is in calibration and the profile determination is completed. If not, carefully adjust fuel flow, allow 0.5 hours for equilibrium and repeat the procedure. Plot the radiant heat energy flux data as a function of distance along the specimen plane on rectangular coordinate graph paper. Carefully draw the best smooth curve through the data points. This curve will hereafter be referred to as the flux profile curve.

(C) Determine the open chamber apparent black body and chamber temperatures that are identified with the standard flux profile by opening the door and moving the specimen platform out. Allow 0.5 hours for the chamber to equilibrate. Read the radiation pyrometer output and record the apparent black body temperature. This is the temperature setting that can be used in subsequent test work in lieu of measuring the radiant flux at 20 cm, 40 cm, and 60 cm using the dummy specimen. The chamber temperature also shall be determined again after 0.5 hours and is an added check on operating conditions.

(vi) *Conditioning.* Test specimens shall be conditioned to equilibrium at 21 ± 3°C (69.8 ± 5.4°F) and a relative humidity of 50 ± 5 percent immediately prior to testing. A less than 1% change in net weight of the specimen in two consecutive weighings with two hours between each weighing constitutes equilibrium.

(vii) *Test Procedure.* (A) With the sliding platform out of the chamber, ignite the radiant panel. Allow the unit to heat for 1 hour. It is recommended that a sheet of inorganic mill-

board be used to cover the opening when the hinged portion of the front panel is open and the specimen platform is moved out of the chamber. The millboard is used to prevent heating of the specimen and to protect the operator. Read the panel apparent black body temperature and the chamber temperature. If these temperatures are in agreement to within ± 5°C (± 9°F) with those determined previously, during the flux profile standardization procedure, the chamber is ready for use.

(B) Mount the specimen tray with insulation on the sliding platform and position with stud bolts (see Figure 11). Ignite the pilot burner, move the specimen into the chamber, and close the door. Start the timer. After 2 minutes preheat, with the pilot burner on and set so that the flame is horizontal and 5 cm above the specimen, bring the pilot burner flame into contact with the center of the specimen at the 0 mark. Leave the pilot burner flame in contact with the specimen for 2 minutes, or until all flaming other than in the area of the pilot burner has ceased, then remove to a position of at least 5 cm above the specimen and leave burning until the test is terminated.

(C) If the specimen does not ignite within 2 minutes following pilot burner flame application, the test is terminated by extinguishing the pilot burner flame. For specimens that do ignite, the test is continued until the flame goes out. When the test is completed, the door is opened, and the specimen platform is pulled out.

(D) Measure the distance burned, i.e., the point of farthest advance of the flame front, to the nearest 0.1 cm (.03 in.). From the flux profile curve, convert the distance to w/cm² (Btu/ft² sec) critical radiant heat flux at flameout. Read to two significant figures. A suggested data log format is shown in Figure 12.

(E) Remove the specimen tray from the moveable platform. The succeeding test can begin as soon as the panel apparent black body temperature and chamber temperature are verified. The specimen tray should be at room temperature prior to insertion of the next specimen.

(viii) *Procedure for calibration of radiation instrumentation.*—(A) *Calibrate pyrometer.* Calibrate the radiation pyrometer by means of a conventional black body enclosure placed within a furnace and maintained at uniform temperatures of 490, 500, and 510° C (914, 932, and 950° F). The black body enclosure may consist of a closed chromel metal cylinder with a small sight hole in one end. Sight the radiation pyrometer upon the opposite end of the cylinder where a thermocouple indicates the black body temperature. Place the thermocouple within a drilled hole and in good thermal contact with the black body. When the black body enclosure has reached the appropriate temperature equilibrium, read the output of the radiation pyrometer. Repeat for each temperature.

(B) *Total heat flux meter.* The total flux meter shall be calibrated by the NBS. (Direct request for such calibration services to the: Radiometric Physics Division, Code 534, National Bureau of Standards (NBS), Washington, DC 20234), or alternatively, its calibration shall be developed by transfer calibration methods with an NBS calibrated flux meter. This latter calibration shall make use of the radiant panel tester as the heat source. Measurements shall be made at each of the nine dummy specimen positions and the mean value of these results shall constitute the final calibration. It is recommended that each laboratory maintain a dedicated calibrated reference flux meter against which one or more working flux meters can be compared as needed. The working flux meters should be calibrated according to this procedure at least once per year.

(4) *Test procedures for smoldering combustion.* Smoldering combustion shall be determined in accordance with the following test procedure. Prepare the insulation to be tested by following the test method for settled density at paragraph (d)(1) of this section.

(i) *Apparatus.* (A) The specimen holder shall be an open-top 20±0.2 cm (7.87±.88 in.) square box, 10±0.2 cm (3.94±.08 in.) in height, fabricated from a single piece of 0.61±0.88 mm thick (24 U.S. Standard gauge) stainless steel sheet with the vertical edges of the box overlapped, not to exceed 7 mm (.28 in.) in seam width, and soldered so as to be watertight. The specimen holder during test use shall rest upon a pad of unfaced glass fiberboard or equivalent having dimensions equal to or greater than those of the bottom of the specimen holder. The unfaced glass fiberboard shall be approximately 2.5 cm (1 in.) thick with a thermal conductivity of 0.30±0.05 cal (g)/hr cm² °C/cm (0.24±0.04 Btu/hr ft² °F/in) at 23.9° C (75° F).

(B) Ignition source. The ignition source shall be a cigarette without filter tip made from natural tobacco, 85±2 mm (3.34±.08 in) long with a tobacco packing density of 0.270±0.020 g/cm³ (16.8±1.24 lb/ft³) and a total weight of 1.1±0.1 gm (0.0024 lb).

(C) Balance. A balance of 1 kg (2.205 lb) capacity, accurate at least to 0.1 g (0.0002 lb), is required.

(D) Test area. The test area shall be draft-protected and equipped with a suitable system for exhausting smoke and/or noxious gases produced by testing. Air velocities as measured by a hot wire anemometer in the vicinity of the surface of the specimen shall not exceed 0.5 m/sec (9.82 ft/sec). The test area shall be at 21±3° C (69.8±5.4° F) and 50±5 percent relative humidity at the time the test begins.

(ii) *Test procedure.* (A) Specimens and cigarettes shall be conditioned in air at a temperature of 21±3°C (69.8±5.4°F) and a relative humidity of 50±5 percent to equilibrium prior to test. A change of less than 1% in net weight of the specimen in two consecutive weighings with two hours between each weighing constitutes equilibrium. Cigarettes shall be removed from any packaging and exposed in a suitable manner to permit free movement of air around them during conditioning. Calculate the weight of material necessary to fill the holder (volume 4,000 cm³ or 0.14 ft³) at the settled density as determined in paragraph (d)(1) of this section. The material shall be blown, combed, or otherwise mixed to remove lumps and shall be loaded uniformly into each specimen holder, level and flush to the top of the holder. The weight of each specimen shall be measured to the nearest 0.2 g (0.007 oz) or less by weighing the holder before and after filling. If the weight of the specimen is less than that calculated, the loaded holder shall be dropped from a height no greater than 7.6 cm. (3 in) onto a hard flat surface and additional material added up to the top edge of the holder. This process shall be repeated until the calculated weight of material has been added and completely fills the holder. With the specimen in the holder and placed on the insulated pad, a rod of 8 mm (.31 in) diameter with a pointed end shall be inserted vertically into the approximate center of the material being tested and withdrawn to form an appropriate cavity for the ignition source, such that the cigarette fits snugly and maintains uniform contact with the specimen. A well lit cigarette, burned not more than 8 mm (0.31 in.), shall be inserted in the formed cavity, with the lit end upward and flush with the specimen surface. Burning of the cigarette and specimen shall be allowed to proceed undisturbed in the test area for at least 2 hours or until the smoldering is no longer progressing, whichever period is longer.

(B) After completion of burning and after the holder has cooled down to approximately room temperature, the specimen holder with its material residue shall be weighed, at least to the nearest 0.1 g (0.0035 oz), and the percent weight loss of the original specimen calculated. The weight of the cigarette residue is ignored in this calculation. (That is, the weight of the cigarette residue is not subtracted

from the net weight of the specimen holder's contents at the conclusion of the test.)

(C) Three specimens per sample shall be tested.

(5) *Test method for flame resistance permanency* [Reserved]

(6) *Test method for starch.* (i) Make a 1.3 litre stock solution of iodine ($I_2$) by dissolving 0.13 gm of $I_2$ in a solution of 2.6 gm of potassium iodide (KI) in 5 ml of water and diluting to 100 ml. Dilute a portion of this to a pale yellow color by mixing 1 volume of stock solution with nine volumes of water each time a test for starch is made.

(ii) Boil 0.5 of the insulation to be tested for several minutes with 10 ml of water. Filter, cooling the filtrate, and add one drop of iodine solution to the filtrate. Observe the color. A blue coloration is conclusive evidence of the presence of starch in the test specimen.

(7) *Test method for moisture absorption*—(i) *Apparatus.* The test sample container shall be 20cm x 20cm x 12.7cm (8 inches square by 5 inches deep).

(ii) Follow the test method for settled density at paragraph (d)(1) of this section from the beginning through the 5-minute shaking.

(iii) Condition the test specimen at 50 ± 2 percent relative humidity and 48.9°C (120°F) to constant weight, and record this first weight. Then increase the relative humidity to 90 ± 2 percent relative humidity, maintain for 24 hours, weigh again, and record this second weight.

(iv) Ascertain whether the second weight is greater than 107 percent of the first weight.

(8) *Test method for odor emission.*—(1) *Apparatus.* Stainless steel or glass containers with all metallic lids, containers and lids to produce no odor of their own.

(ii) Soak a 50 gm test specimen in distilled water at a temperature of 65°C (150°F) for 30 minutes in a closed container.

(iii) Then have a panel of five persons with normal odor perception examine the test specimen for odor using the following questions:

(A) Was there an odor?

(B) If yes, was the odor objectionable, pleasant or otherwise?

(C) If objectionable, was the odor weak, strong or very strong?

(iv) The test specimen shall be determined to have an objectionable odor if a majority of the panel finds an objectionable odor which is strong or very strong.

(9) *Test procedures for corrosiveness.* Determination of corrosiveness shall be in accordance with the following test procedure:

(i) *Apparatus and materials.* (A) Humidity chamber. A forced-air humidity chamber capable of maintaining 48.9 ± 1.7°C (120 ± 3°F) and 97 ± 1.5 percent relative humdity.

(B) Crystallizing dishes. Six, glass, 90 mm (3.54 in.) diameter by 50 mm (1.9 in.) height.

(C) Test coupons: Two each, 50.8 by 50.8 by 50.8 mm (2 by 2 in.) by 0.076 mm (0.003 in.) thick metal free of tears, punctures, or crimps as follows:

3003 bare aluminum, zero temper.

ASTM B 152, type ETP, Cabra No. 110 soft copper.

Low carbon, commercial quality, cold rolled, less than 30 carbon content, shim steel.

(D) Test specimens: Six test specimens of insulation shall be used for one test. Each specimen shall weigh 20 g (0.7 oz). Prepare the insulation to be tested by following the test method for settled density at paragraph (d)(1) of this section.

(ii) *Procedure.* The metal coupons shall be cleaned by the following method:* At no time during the fabrication, cleaning or testing, shall the metal coupons be touched by ungloved hands. All chemicals used shall be of certified American Chemical Society reagent grade or better, free from oily residues and other contaminants. Water shall be distilled or deionized water. Handle cleaned coupons only with clean forceps. Clean copper coupons until completely free of water-breaks. A water-break is defined as a break, separation, beading or retraction of the water film as the coupon is held vertically after wetting. The water film should become gradually thinner at the top and heavier at the bottom. Immerse the coupons in refluxing or boiling 1,1,1-trichloroethane (TCE) for 2 hours or by ultrasonic cleaning in TCE for 12 minutes, minimum. Rinse coupons with fresh TCE twice. Air dry. Rinse with water. Inspect for water-break free surface. Hot air dry.

Clean steel coupons until completely free of water-breaks. Immerse the coupons in room temperature TCE for 15 minutes with agitation. Rinse coupons with fresh TCE twice. Air dry. Immerse the coupons in 5 percent by weight aqueous sodium hydroxide at 60°C for 15 minutes with occasional agitation. Rinse with water until no residual caustic is present. Immerse the coupons in refluxing or boiling ethanol for 5 minutes. Rinse coupons in fresh, room temperature ethanol twice. Rinse with water and inspect for a water-break free surface. Rinse with fresh ethanol and air dry.

Clean aluminum coupons until completely free of water-breaks. Immerse the coupons with occasional agitation in room temperature TCE for 15 minutes, followed by rinsing coupons with fresh TCE twice. Air dry. Immerse the coupons for *one* minute in 1.42 specific gravity nitric acid. Rinse with water until no residual acid is present. Inspect for water-break free surface. Hot air dry.

Specimens of cellulosic insulation submitted for testing shall be blown, combed, or otherwise mixed to reasonably assure homogeneity in the cellulosic insulation test specimens.

Before presaturating each 20 g (0.7 oz) test specimen, subdivide it into two 10g portions. The quantity of distilled water to be used for each 10g (.35 oz) portion shall be determined using the following formula:

$$\text{ml distilled water} = \frac{40}{\text{settled density Kg/m}^3} \times 75$$

or

$$\frac{2.5}{\text{settled density lbs/ft}^3} \times 75$$

Presaturate each 10g (.35 oz) portion with the determined amount of water. Place one presaturated 10g (.35 oz) portion into a crystallizing dish, tamp level using the bottom of a clean suitably sized glass beaker. Place a metal coupon onto the presaturated insulation portion and center it in a horizontal plane. Place the other presaturated 10g (.35 oz) portion into the crystallizing dish on the metal coupon and tamp the composite specimen (metal coupon plus saturated insulation in the crystallizing dish) to assure an even distribution of this material and

*CPSC has determined the following method to be suitable for cleaning presently available metal coupons to a water-break free criterion. Because protective coatings used with the coupons may change in the future, other cleaning steps may be necessary in order to meet the water-break free criterion; however, the physical integrity of the coupons must not be impaired.

to assure good contact of the insulation with the metal.

Do not cover the crystallizing dish. (Care should be taken to avoid evaporation from the composite specimen while it is being prepared until it is placed in the humidity chamber.) If dripping occurs in the chamber, position a drip guard in the chamber to divert condensation to the chamber floor. Repeat the above for the other metal coupons. Place all six composite specimens into the humidity chamber. The chamber shall be preconditioned to 48.9 ± 1.7°C (120 ± 3°F) and 97 ± 1.5 percent relative humidity. The specimens shall remain in the chamber for 336 ± 4 hours. (Keep openings of the chamber door to a minimum while placing composite specimens in and removing them from the chamber.)

Upon completion of the test disassemble the composite specimens. Thoroughly wash the metal coupons under running water and lightly brush them using a nylon bristle brush or equivalent to remove loose corrosion products. Remove the remaining corrosion products from the metal coupons by cleaning them in accordance with recommended practices identified in ASTM G1—Standard Recommended Practice for Preparing, Cleaning, and Evaluation Corrosion Test Specimens.

After cleaning, examine the metal coupons over a 40-w appliance light bulb for perforation.

(iii) *Noncorrosiveness.* Noncorrosiveness shall be determined by the absence of any perforations, excluding notches which extend into the coupon 1 mm or less from any edge, when the coupons are observed over a 40-w appliance light bulb.

(10) *Test method for fungi resistance.*

(i) Follow MIL-STD-810, method 508, except that spore suspensions shall be prepared using distilled water and that the core of ½ inch regular gypsum wallboard shall be used as the control.

(ii) Examine the test samples of insulation and the control at 40X magnification for evidence of fungal growth.

(iii) Ascertain whether any of the test samples show more fungal growth than the control.

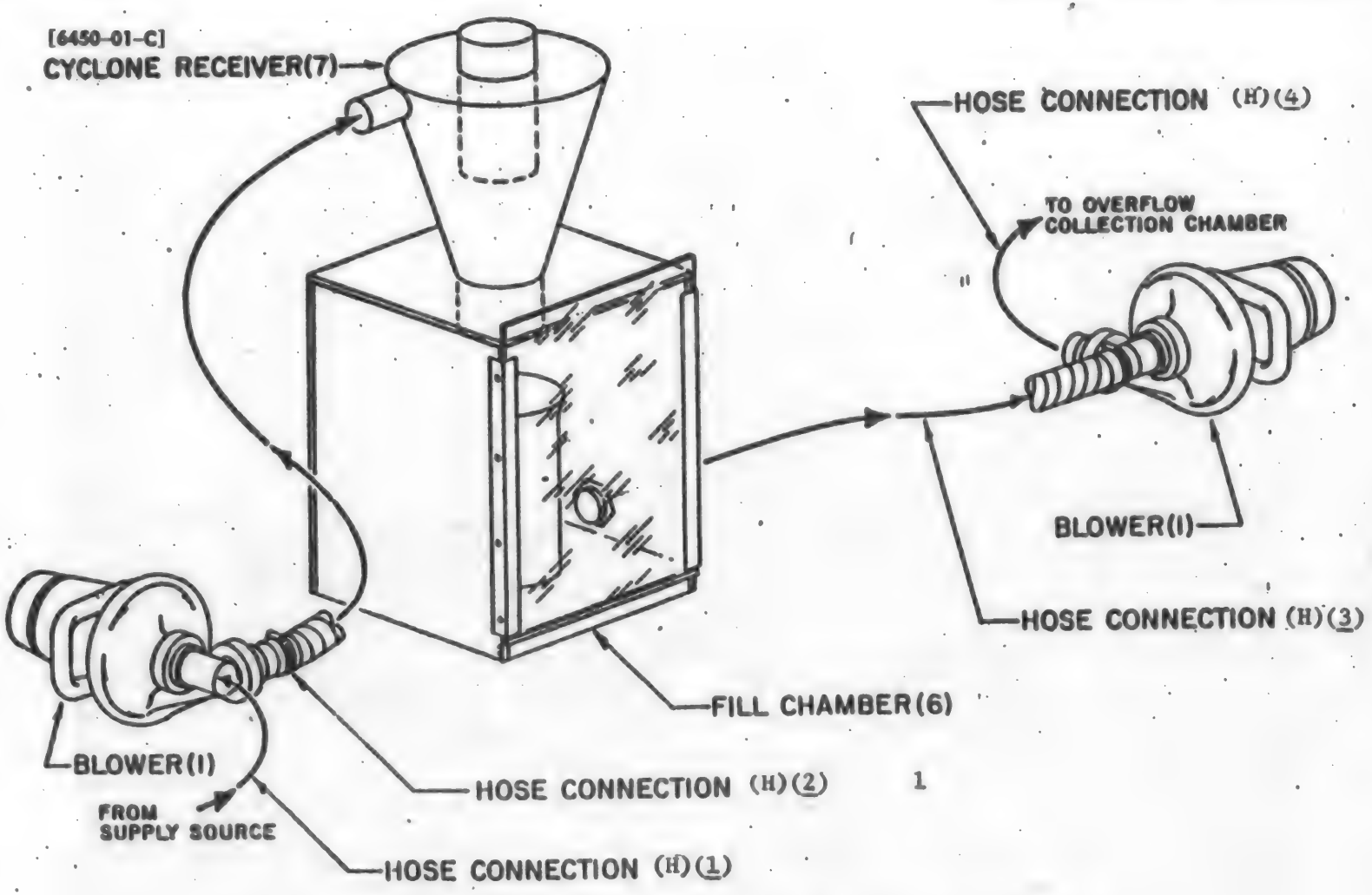



FIG 1—PARTIAL INSULATION PREPARATION APPARATUS

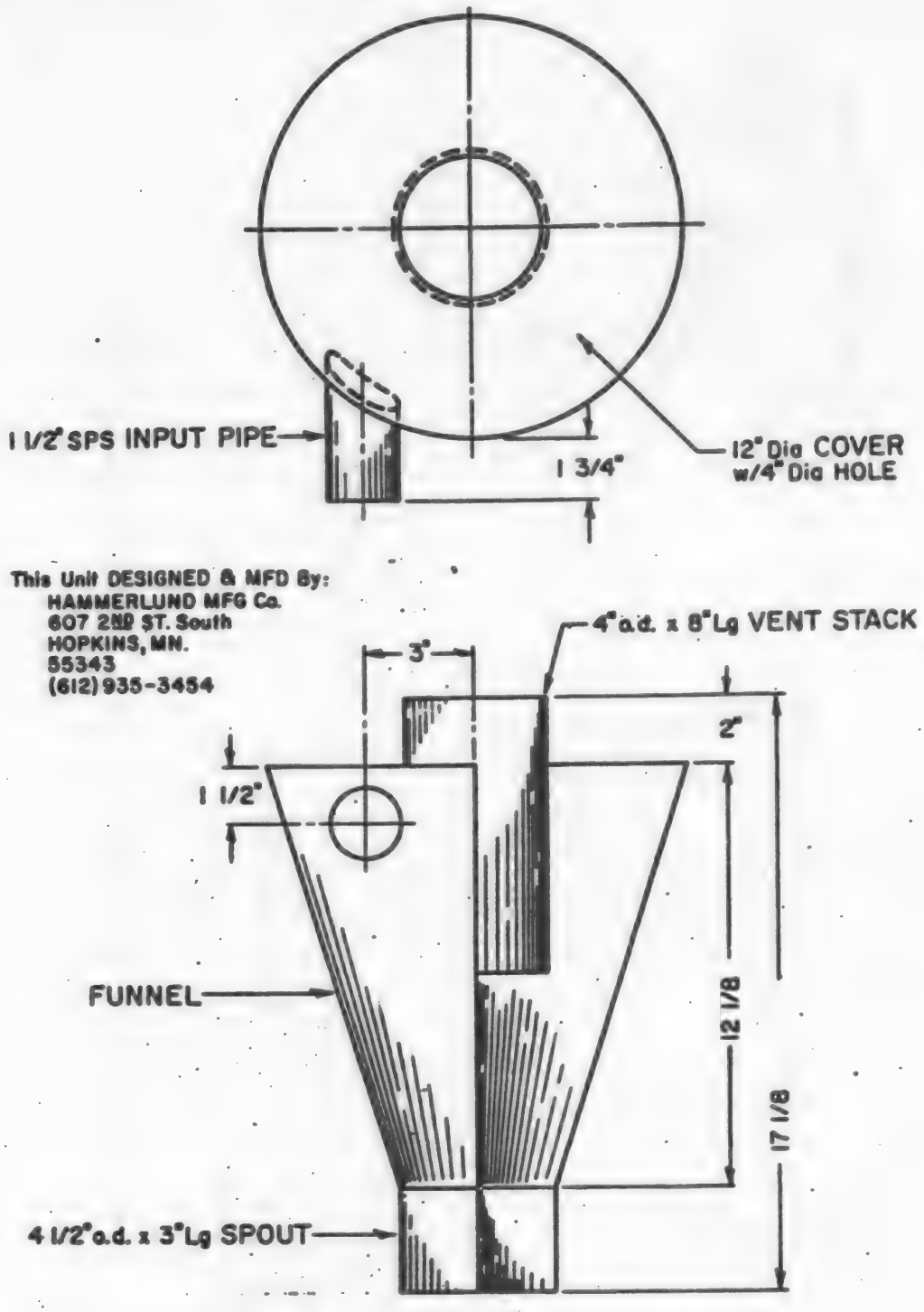



FIG 2—CYCLONE RECEIVER WELDMENT

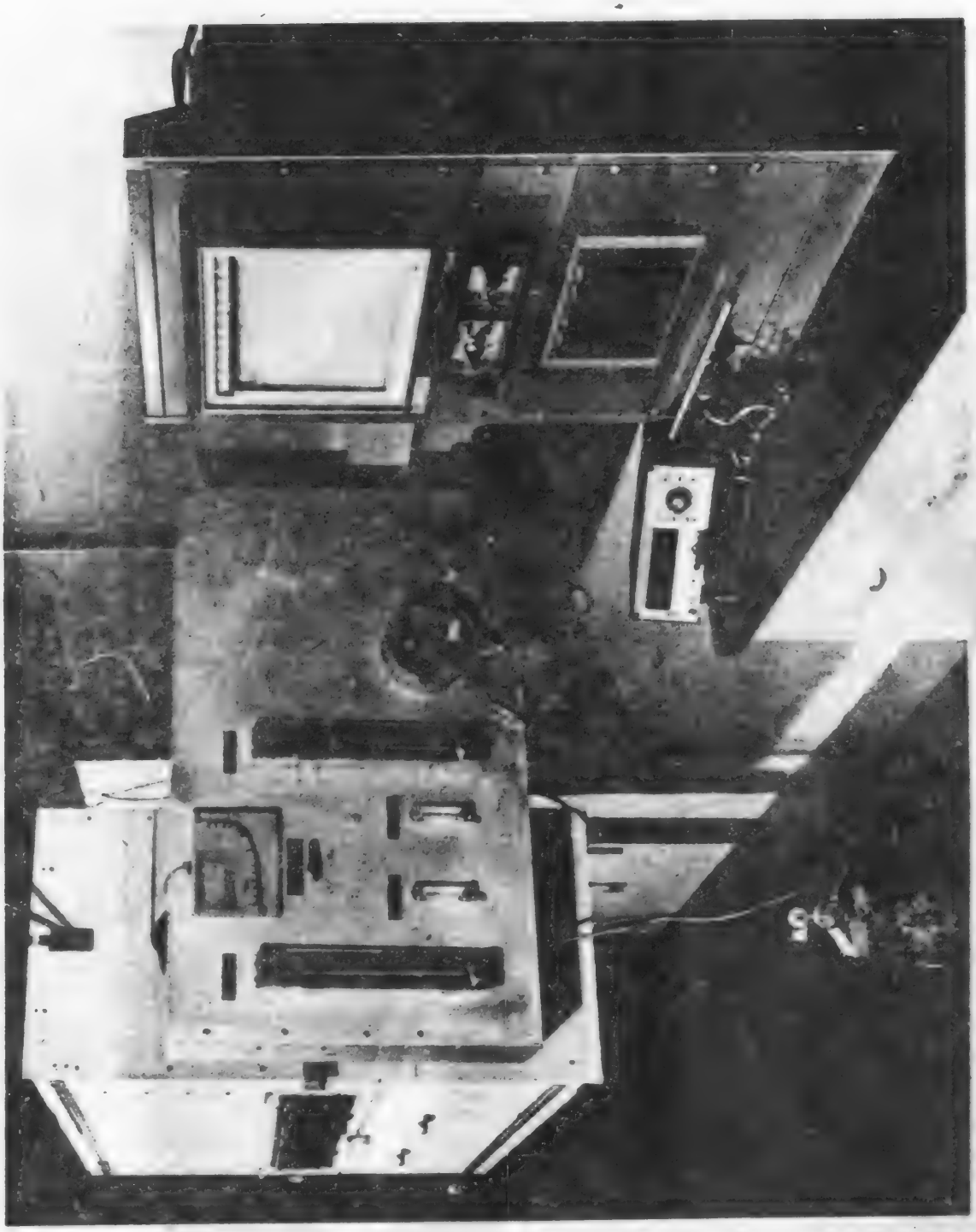
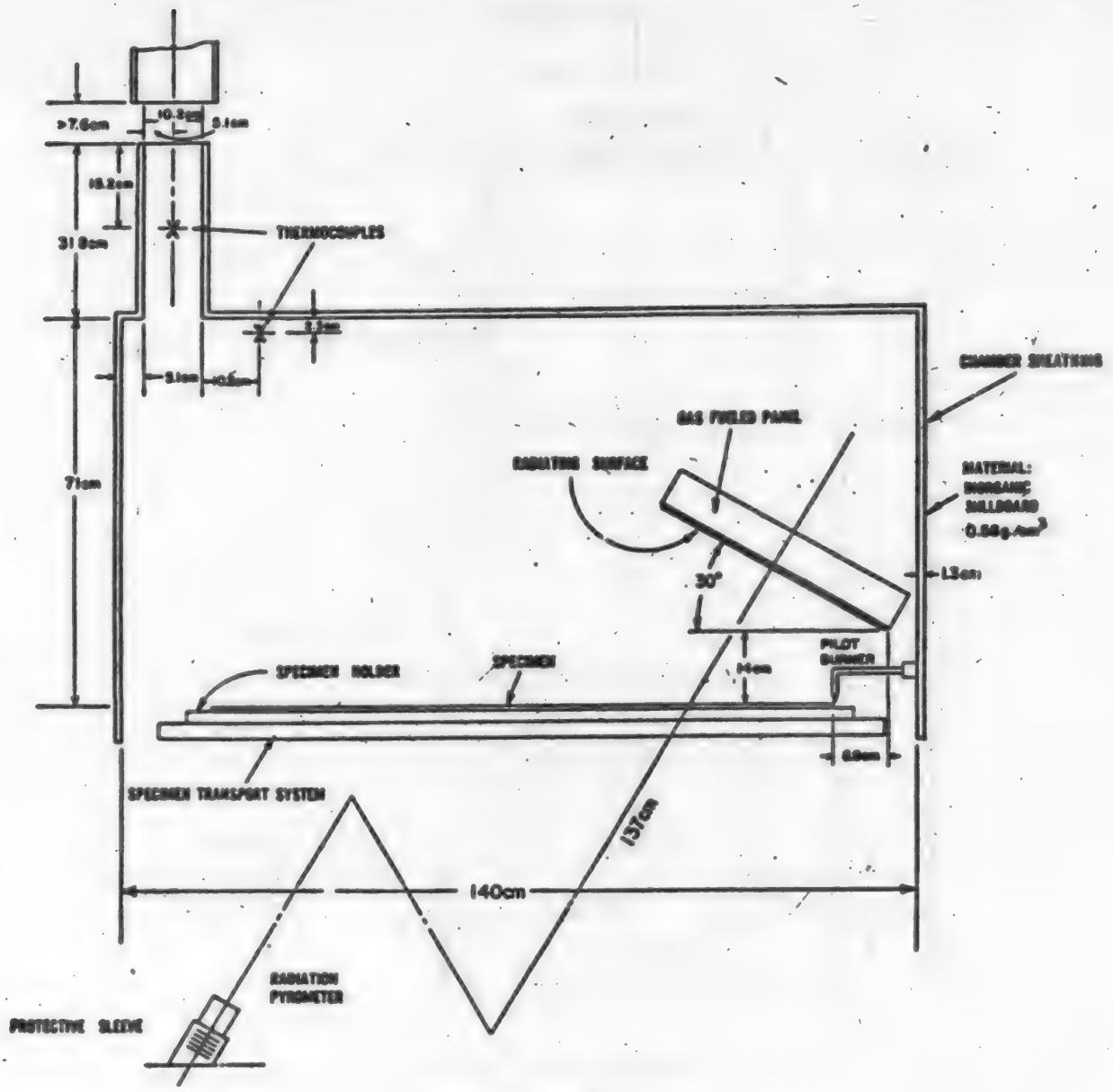


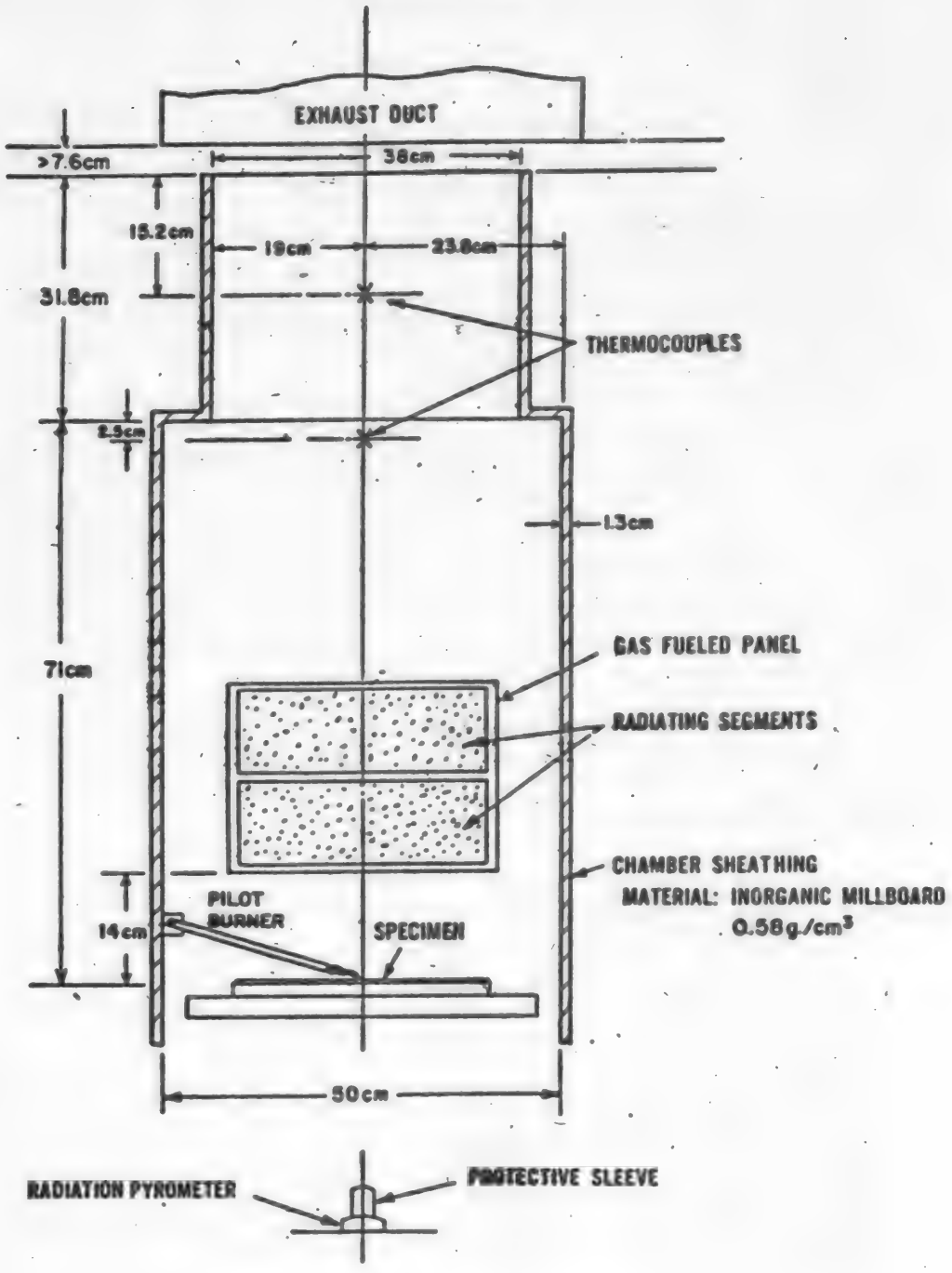
Figure 3

Figure 4



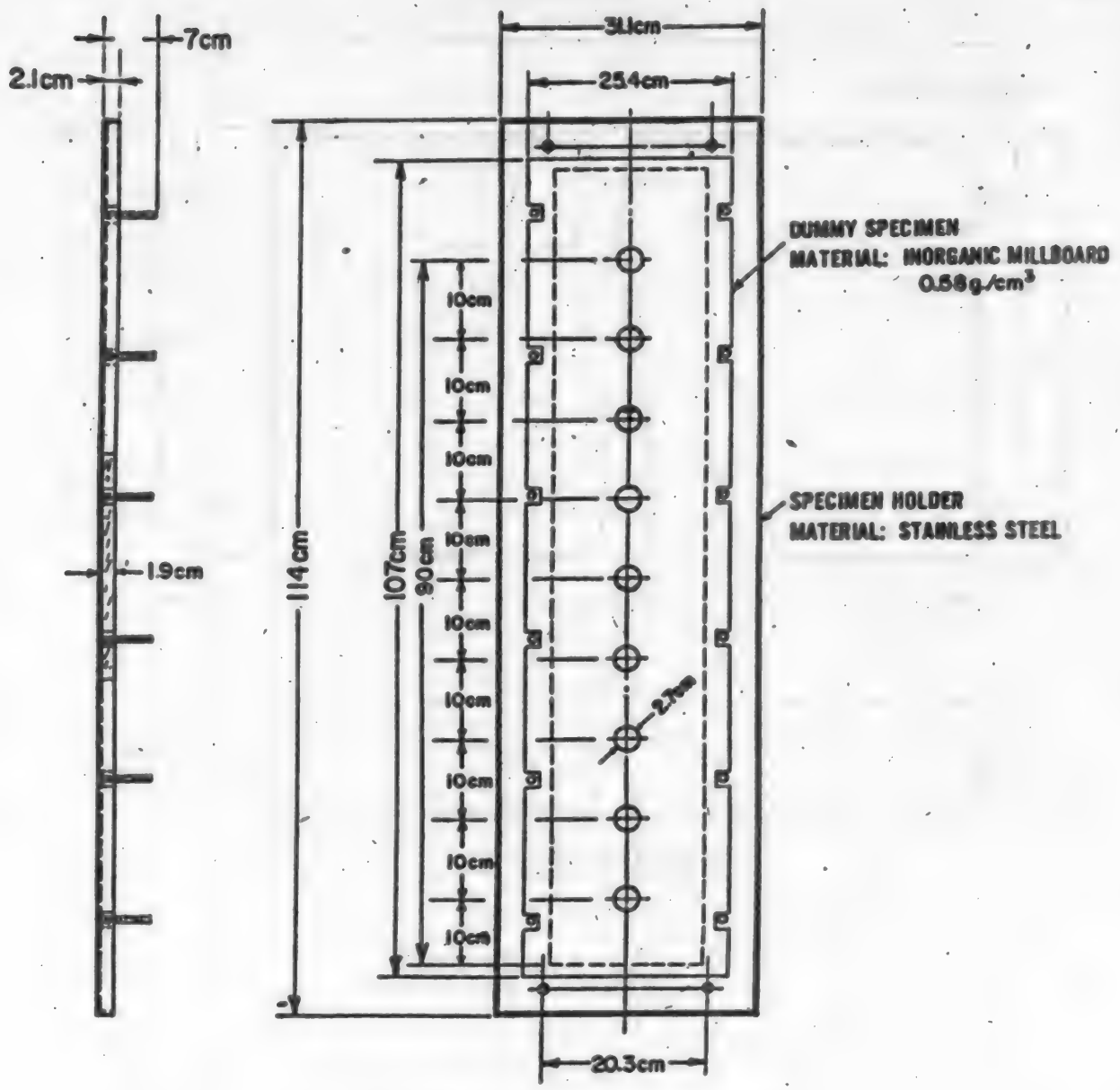

FLOORING RADIANT PANEL TESTER SCHEMATIC
SIDE ELEVATION

Figure 3



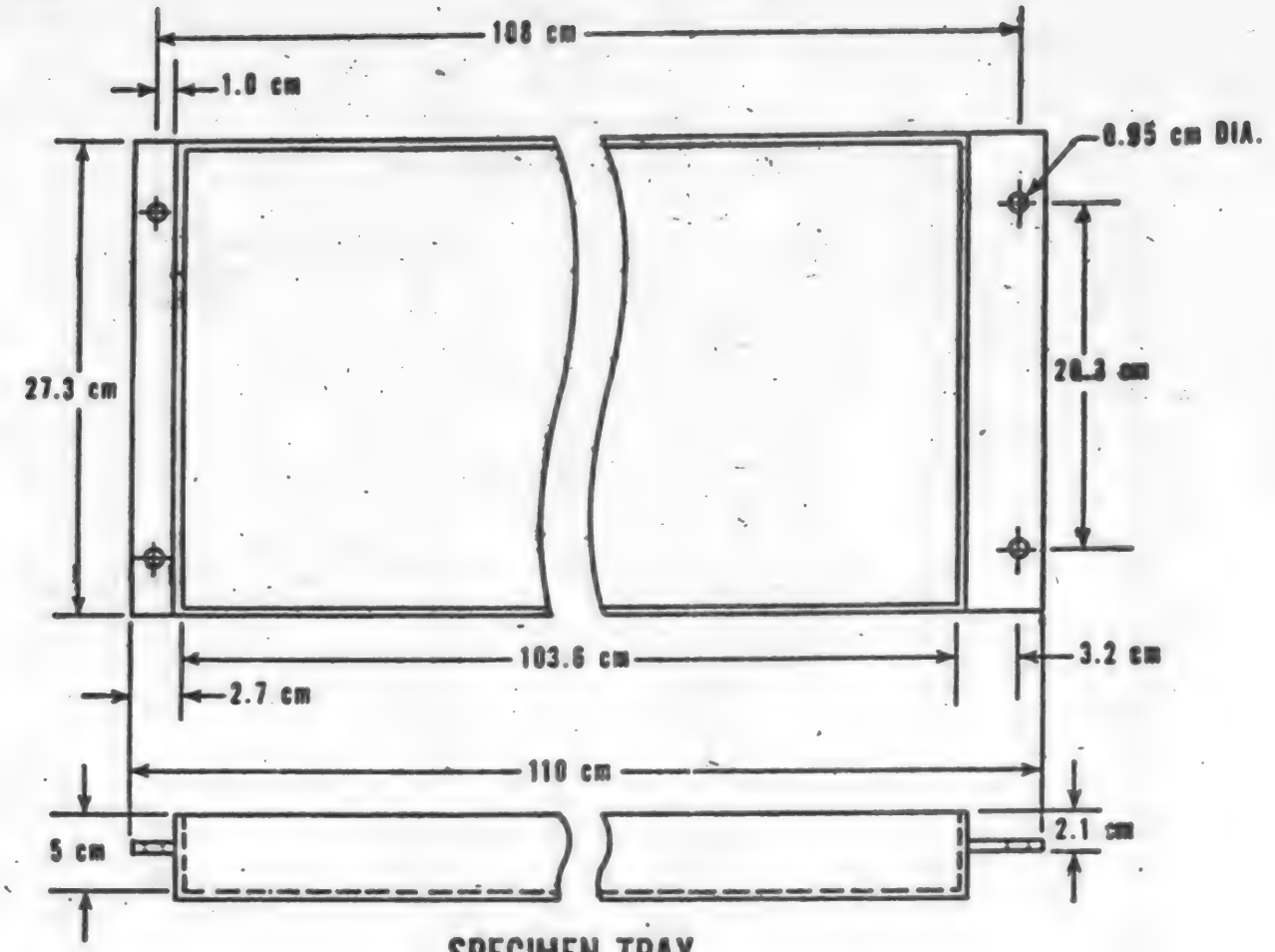

FLOORING RADIANT PANEL TESTER SCHEMATIC
LOW FLUX END, ELEVATION

Figure 6




DUMMY SPECIMEN IN SPECIMEN HOLDER

Figure 7




SPECIMEN TRAY

Figure 8

RADIANT FLUX PROFILE

Date_____

Black Body Temperature_____m.v. _____°C (°F)

Gas Flow_____NTPm$^3$H (SCFH) Air Flow_____NTPm$^3$H (SCFH)

Room Temperature_____°C (°F)

Air Pressure _____ Gas_____cm (in) of $H_2O$

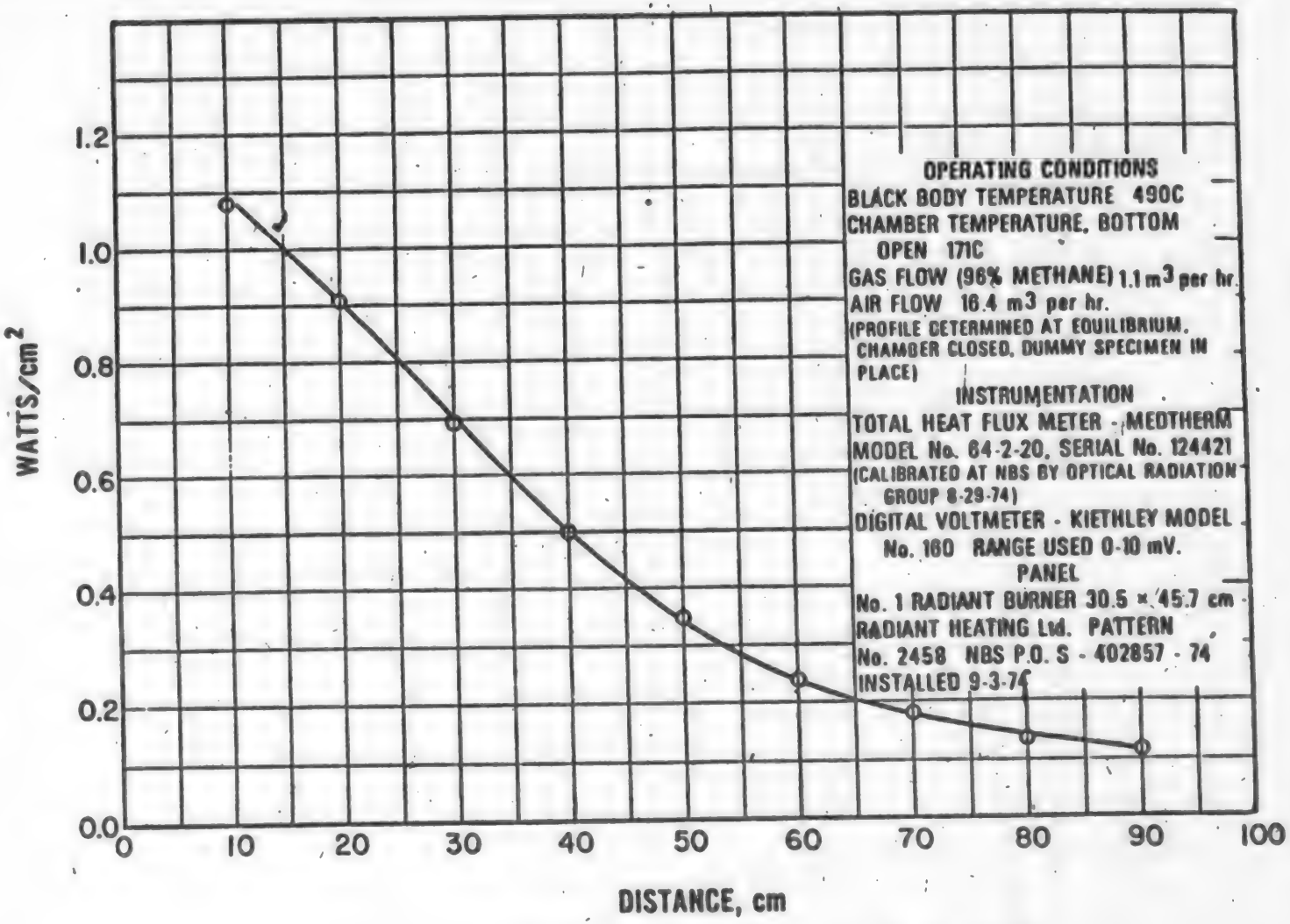
Flux Meter Conversion Factor_____

Radiometer No._____ from Calibration on_____

| Distance (cm) | MV | Watts/cm$^2$ |
|---|---|---|
| 10 | _____ | _____ |
| 20 | _____ | _____ |
| 30 | _____ | _____ |
| 40 | _____ | _____ |
| 50 | _____ | _____ |
| 60 | _____ | _____ |
| 70 | _____ | _____ |
| 80 | _____ | _____ |
| 90 | _____ | _____ |

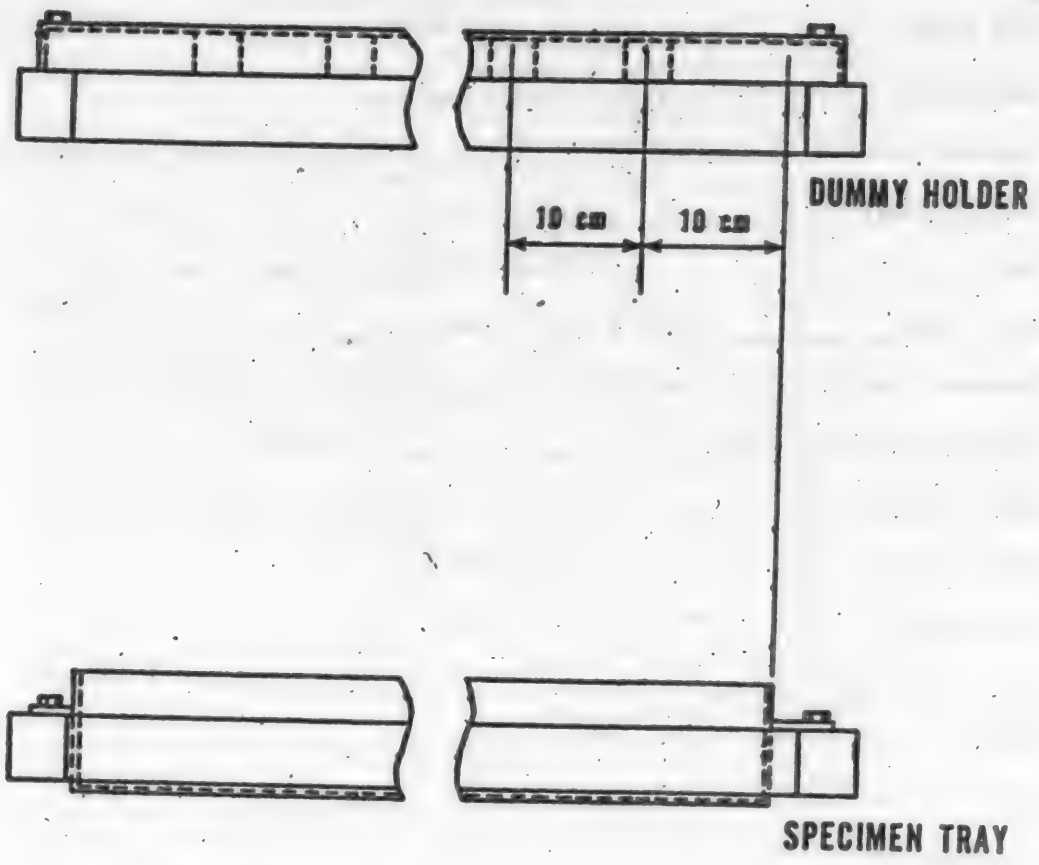
Signed _____

Figure 9. Flux Profile Data Log Format




STANDARD RADIANT HEAT ENERGY FLUX PROFILE

Figure 10




SPECIMEN TRAY MOUNTING POSITION

Figure 9/

Test Number _____ Date _____ Time _____

Laboratory _____

Specimen Identification/Code No. _____

Test Assembly: _____

Panel: Angle _____° Temperature _____°C (°F)

Flow: Gas _____ $NTPm^3H$ (SCFH) Air _____ $NTPm^3H$

Pressure, cm (in) $H_2O$: Initial, Air _____ Gas _____

Chamber Temperature (Initial) _____°C (°F)

Room: Temperature _____°C (°F) Hood Draft _____cm (in) water

Flame Front Out _____ min.

All Flame Out _____ min.

Total Burn Length _____cm (in)

Critical Radiant Flux watts/$cm^2$ _____

Flux Profile Reference _____

Observations:

Signed _____

Figure 19. Insulation Radiant Panel Test Data Log Format

[6450-01-M]

§ 456.804 Standards for loose-fill mineral fiber insulation.

(a) *Scope.* This section applies to Class A loose-fill mineral fiber thermal insulation and Class B loose-fill mineral fiber thermal insulation.

(b) *Definitions.* (1) "Loose-fill mineral fiber insulation" means insulation composed of mineral substances such as slag, rock, or glass, suitable for pneumatic or poured application.

(2) "Class A" loose-fill mineral fiber insulation is mineral fiber that has a weight loss on ignition of no greater than one percent. "Class B" is mineral fiber having a weight loss on ignition greater than one percent but less than or equal to 12 percent.

(3) "ASTM C 553" means ASTM Standard Specification for Mineral Fiber Blanket and Felt Insulation (Industrial Type).

(4) "ASTM C 687" means Standard Recommended Practice for Determination of the Thermal Resistance of Low Density Fibrous Loose-fill Type Building Insulation.

(c) *Physical requirements*—(1) *Design density.* The design density of loose-fill mineral fiber insulation to be used in computing the coverage chart (Table II) shall be determined in accordance with the method specified in paragraph (d)(1) of this section.

(2) *Thermal resistance.* The thermal resistance (R-value) of loose-fill mineral fiber to be used in computing the coverage chart (Table II) shall be determined in accordance with the test method specified in paragraph (d)(2) of this section. The R-value for any given sample of loose-fill mineral fiber insulation shall not average more than five percent below the listed R-value for any loose-fill insulation.

(3) *Fire safety*—(i) *Weight loss on ignition.* The weight loss on ignition of Class A loose-fill mineral fiber insulation shall be no greater than one percent. The weight loss on ignition of Class B loose-fill mineral fiber insulation shall be no greater than 12 percent. This shall be verified by testing in accordance with the test method described in paragraph (d)(3) of this section.

(ii) *Critical radiant flux.* The critical radiant flux of loose-fill mineral fiber insulation shall be no less than 0.12 Watts/cm$^2$. This shall be verified by testing in accordance with the test method described in paragraph (d)(3) of this section.

(iii) *Smoldering combustion.* Loose-fill mineral fiber insulation shall not flame or show a weight loss greater than 15 percent of the initial weight when tested in accordance with the test method described in paragraph (d)(4) of this section.

(4) *Moisture adsorption.* The moisture adsorbed by loose-fill mineral fiber insulation from exposure to humidity shall be no greater than five percent by weight when tested in accordance with the test method described in paragraph (d)(6) of this section.

(5) *Odor emission.* Loose-fill mineral fiber insulation shall not have a detectable odor which could be found objectionable by testing in accordance with the test method described in paragraph (d)(7) of this section.

(6) *Corrosiveness.* Under conditions specified in paragraph (d)(8) of this section, loose-fill mineral fiber insulation shall cause no greater corrosion of metal than sterile cotton when tested in accordance with the test method described in paragraph (d)(8) of this section.

(7) *Fungi resistance.* Loose-fill mineral fiber insulation shall show no more fungal growth than the control material would show by testing in accordance with paragraph (d)(9) of this section.

(8) *Marking.* Each bag of insulation shall be marked with the following information:

(i) Name of manufacturer.

(ii) Recommended method of application (blowing or pouring).

(iii) Minimum net weight of insulation.

(iv) Table II filled in to show manufacturer's recommended insulation thickness and maximum coverage per bag for specified thermal resistance values.

Where the insulation is intended for application by either blowing or pouring, the bag shall have a separate coverage chart for each type of application.

## TABLE II COVERAGE CHART

| To Obtain Thermal Resistance* (R-Value) of | Minimum Number of Bags per 1000 Sq.Ft. (MSF) | Installed Insulation Should Not Be Less Than: | Maximum Sq.Ft. Coverage per Bag | The weight per Sq.Ft. of Installed Insulation Should Be Not Less Than** |
|---|---|---|---|---|
| ATTIC | | | | |
| R-40 | bags/MSF | _____ inches thick | _____ sq. ft. | _____ lbs/sq.ft. |
| R-32 | bags/MSF | _____ inches thick | _____ sq. ft. | _____ lbs/sq.ft. |
| R-24 | bags/MSF | _____ inches thick | _____ sq. ft. | _____ lbs/sq.ft. |
| R-19 | bags/MSF | _____ inches thick | _____ sq. ft. | _____ lbs/sq.ft. |
| R-13 | bags/MSF | _____ inches thick | _____ sq. ft. | _____ lbs/sq.ft. |
| SIDEWALLS | | | | |
| R-__ | bags/MSF | 2 inches thick (nominal) | _____ sq. ft. | _____ lbs/sq.ft. |
| R-__ | bags/MSF | 4 inches thick (nominal) | _____ sq. ft. | _____ lbs/sq.ft. |
| R-__ | bags/MSF | 6 inches thick (nominal) | _____ sq. ft. | _____ lbs/sq.ft. |

*At 75°F Mean Temperature*

**Based on settled density as determined in (d)(1).

[6450-01-M]

(v) The following warning:

*Clearance around heat sources:* Recessed lights and certain electrical devices require clearances from insulation material. Do not install within three inches of these devices.

*Skin irritation:* During installation, insulation material can cause some local skin irritation; protect skin by wearing loose clothing, including gloves. Wash work clothing separately from other clothing.

*Eye and lung protection:* To prevent irritation to eyes and lungs from fibers which may become airborne during installation, a dust mask and goggles are suggested.

(d) *Test methods*—(1) *Test method for design density.* [Reserved]

(2) *Test method for thermal resistance.* (i) Perform all testing at a mean temperature of 23.9°C (75°F).

(ii) Prepare the insulation to be tested by following the test method for design density at paragraph (d) (1) of this section.

(iii) Determine the thermal conductance of four samples in accordance with either ASTM C 177, C 518 or C 236. In case of a question, ASTM C 177 shall be used to determine the thermal conductance of the standard reference material used to calibrate the C 518 or C 236 apparatus. Alternatively, ASTM C 687 may be used except that density shall be determined in accordance with paragraph (d)(1) of this section.

(iv) Calculate the thermal resistance (R-value) of each sample by taking the reciprocal of each sample's thermal conductance.

(v) Calculate the arithmetic average of the R-values of the four samples. This arithmetic average is the thermal resistance (R-value) of the loose-fill mineral fiber insulation which has been tested.

(3) *Test method for weight loss on ignition.* (i) Heat insulation specimen in an oven at 104° C (220° F) for 30 minutes to remove moisture.

(ii) Place a 10.00 gm specimen in a porcelain crucible of known weight. Place the crucible in a cool muffle furnace and heat at 427° C (800° F) for two hours.

(iii) Remove the crucible from the furnace and cool to room temperature. Weigh the crucible containing the specimen and deduct the tare weight of the crucible.

(iv) Ascertain whether the specimen weighs less than 99.0 percent of the weight determined in paragraph (B) if it is Class A loose-fill mineral fiber insulation. Ascertain whether it weighs less than 88.0 percent if it is Class B insulation.

(4) *Test method for critical radiant flux.* See § 456.803(d)(3). Perform the test at the design density as determined in § 456.804(d)(1).

(5) *Test method for smoldering combustion.* See § 456.803(d)(4). Perform the test at the design density as determined in § 456.804(d)(1).

(6) *Test method for moisture adsorption.* Moisture adsorption shall be determined in accordance with the test method specified in ASTM C 553.

(7) *Test method for odor emission.* (i) Apparatus. Stainless steel or glass containers with all metallic lids, containers and lids to produce no odor or their own.

(ii) Soak a 50 gm test specimen in distilled water at a temperature of 65° C (150° F) for 30 minutes in a closed container.

(iii) Have a panel of five persons with normal odor perception examine the test specimen for odor using the following questions:

(A) Was there an odor?

(B) If so, was the odor objectionable, pleasant or otherwise?

(C) If objectionable, was the odor weak, strong or very strong?

(iv) The test specimen shall be determined to have an objectionable odor if a majority of the panel finds an objectionable odor which is strong or very strong.

(8) *Test method for corrosiveness.* Perform this test at the design density as determined in § 456.804(d)(1).

(i) *Apparatus and materials.* (A) Humidity chamber capable of maintaining 49°±1° C (120°±3° F) and a relative humidity of 95±3 percent.

(B) Two steel plates, 2.54 by 10.2 cm (1 × 4 in.) and .51 mm (.020 inches) thick, bright No. 2 finish, cold rolled strip steel, quarter hard, temper No. 3.

(C) Four woven wire screens, 3.8 × 11.4 cm (1.5 × 4.5 inch), 1.1 cm (7/16 inch) open square grid, made of 1.6 mm (0.63 inch) wire, 304 stainless steel.

(D) Four No. 12 rubber bands.

(E) Two pieces of sterile cotton, 3.8 × 11.4 cm.

(ii) *Preparation.* Prepare two insulation specimens, each 3.8 × 11.4 cm (1.5 × 4.5 inch) by 12.7 m (0.5 inch) thick when compressed against the metal test plates as described in the subparagraph below. Clean the steel plates until completely free of water breaks by vapor degreasing for five minutes followed by bathing them in hot caustic bath of 15 percent KOH solution for 15 minutes. Rinse the plates thoroughly in distilled water and immediately dry. Solvent extract the sterile cotton in ACS reagent grade acetone for 48 hours and vacuum dry at low heat.

(iii) Place one steel plate between the two insulation specimens, compress between two wire screens, and secure with a rubber band at each end.

(iv) Place the other steel plate between the pieces of cotton and secure as in the preceding paragraph.

(v) Vertically suspend both the insulation-covered and cotton-covered plates in the humidity chamber and maintain at 49°±1° C (120°±3° F) and 95±3 percent relative humidity for 168±4 hours.

(vi) Upon completion of these procedures, remove both steel plates and ascertain whether the plate which had been insulation covered shows more corrosion that the plate which had been cotton covered.

(9) *Test method for fungi resistance.* (i) Follow MIL-STD-810, method 508, except that spore suspension shall be prepared using distilled water and that the core of ½ inch regular gypsum wallboard shall be used as the control.

(ii) Examine the test samples of insulation and the control at 40X magnification for evidence of fungal growth.

(iii) Ascertain whether any of the test samples show more fungal growth than the control.

### § 456.805 Standards for Mineral Fiber Blanket and Batt Thermal Insulation

(a) *Scope.* This section applies to mineral fiber blanket and batt thermal insulation.

(b) *Classification.* Two types of mineral fiber blanket and batt insulation are defined. They are

*Type I*—Blankets and batts with no membrane covering

*Type II*—Blankets and batts with a reflective or non-reflective membrane covering on one principal face.

(c) *Applications.* Mineral fiber blanket and batt thermal insulation is suitable for the following areas of application:

(1) Open attic floors;

(2) Enclosed spaces;

(3) Ceilings of unheated basements and crawl spaces.

(d) *Definitions.* (1) "Mineral fiber blanket and batt thermal insulation" means flexibile units composed of felted inorganic fibers in rolls or strips, with or without attached membrane coverings.

(2) "ASTM C 553" means ASTM Standard Specification for Mineral Fiber Blanket and Felt Insulation.

(3) "ASTM C 653 means ASTM Method for Determination of the Thermal Resistance of Low-Density Mineral Fiber Blanket-Type Building Insulation.

(e) *Physical Requirements*—(1) *Thermal resistance.* The R-value for any given sample of mineral fiber blanket and batt thermal insulation shall not be more than five percent below the arithmetic average of the R-values of four specimens tested in accordance with the test method described in paragraph (f)(1) of this section.

(2) *Fire safety*—(i) *Critical radiant flux.* The critical radiant flux of Type I and II mineral fiber blanket and batt thermal insulation shall be not less than 0.12 watts/cm². This shall be verified by testing in accordance with the test method described in § 456.803(d)(3).

(ii) *Smoldering combustion.* Mineral fiber blanket and batt thermal insulation (both types I and II) shall not flame or show a weight loss greater than 15 percent of the initial weight when tested in accordance with § 456.803(d)(4).

(3) *Vapor permeance.* (i) Vapor resistnat membrane coverings on mineral fiber blanket and batt thermal insulation shall have a vapor permeance of not more than 1.0 perm. This shall be verified by testing in accordance with the test method described in paragraph (f)(4) of this section.

(ii) Vapor permeable membrane coverings on mineral fiber blanket and batt thermal insulation shall have a vapor permeance of not less than five perms. This shall be verified by testing in accordance with the method described in paragraph (f)(4) of this secton.

(4) *Dimensional data*—(i) *Thickness.* The thickness of mineral fiber blanket and batt thermal insulation shall be not less than that required to provide the thermal resistance value specified.

(ii) *Tolerances.* The dimensional tolerance on a specified length of mineral fiber blanket or batt thermal insulation shall be 12.7 mm (0.5 inch) for blankets 254 cm (100 inches) or shorter, and 0.5 percent for blankets longer than 254 cm. The tolerance on a specified width shall be 12.7 mm (0.5 inch).

(5) *Moisture adsorption.* The moisture adsorbed by mineral fiber blanket and batt thermal insulation from exposure to humidity shall be no greater than five percent by weight when tested in accordance with the test method described in paragraph (f)(5) of this section.

(6) *Odor emission.* Mineral fiber blanket and batt thermal insulation shall not have a detectable odor which would be found objectionable by testing in accordance with the test method described in pararaph (f)(6) of this section.

(7) *Corrosiveness.* Under conditions specified in paragraph (f)(7) of this section mineral fiber blanket and batt thermal insulation shall cause no greater corrosion of metal than sterile cotton. This shall be verified by testing in accordance with the test method specified in paragraph (f)(7) of this section.

(8) *Fungi-resistance.* Mineral fiber blanket and batt thermal insulation shall show no evidence of fungal growth when tested in accordance with the method described in paragraph (f)(8) of this section.

(9) *Identification marking*—(i) *Insulation blankets.* Mineral fiber blanket and batt thermal insulation shall be marked with the manufacturer's name or trademark, the thermal resistance (R-value) of the insulation and the thickness required to obtain this thermal resistance R-value. On each Type I insulation blanket, the identification marking shall be printed on a label, branded, or indelibly marked at intervals not exceeding eight linear feet. On Type II insulation blankets, the identification marking shall be printed on the membrane covering at intervals not exceeding eight linear feet. Identification marking on Types I and II blankets shall also contain the following warning:

*Clearance around heat sources:* Recessed lights and certain electrical devices require clearances from insulation material. Do not install within three inches of these devices.

*Skin irritation:* during installation, insulation material can cause some local skin irritation; protect skin by wearing loose clothing, including gloves. Wash work clothing separately from other clothing.

*Eye and lung protection:* To prevent irritation to eyes and lungs from fibers which may become airborne during installation, a dust mask and goggles are suggested.

In addition to the above warning, identification marking on Type II blankets shall contain this warning:

*"Caution—This membrane covering is flammable. When installed, it should not be exposed."*

(ii) *Shipping bags and wrapping.* Shipping bags and wrapping for insulation blankets shall be marked with the manufacturer's name or trademark, the length, width, thickness, the R-value of the insulation, the square feet of insulation, and the type.

(iii) *Shipping containers.* Shipping containers for insulation blankets shall be marked with the manufacturer's name or trademark, the length, width, and the R-value of the insulation.

(f) *Testing methods*—(1) *Test method of thermal resistance.* Thermal resistance shall be determined in accordance with ASTM C 177, C 236, C 518, or C 653.

(2) *Test method for critical radiant flux.* See § 456.803(d)(3). Type II blankets shall be tested with the membrane covering faced down in the tray. When Type II blankets are furnished with breather paper, the insulation shall be tested with the breather paper faced up in the tray.

(3) *Test method for smoldering combustion.* See § 456.803(d)(4). Test the mineral fiber blanket without the membrane covering.

(4) *Test method for vapor permeance.* Vapor permeance shall be determined in accordance with procedure A of ASTM E 96.

(5) *Test method for moisture adsorption.* Moisture adsorption shall be determined in accordance with ASTM C 553 Section 15.

(6) *Test method for odor emission.* See § 456.804(d)(7).

(7) *Test method for Corrosiveness.* See § 456.804(d)(8).

(8) *Test method for fungi resistance.* See § 456.804(d)(9).

### § 456.806 Standards for vermiculite thermal insulation.

(a) *Scope.* This section applies to expanded or exfoliated vermiculite thermal insulating material, Types I and II. (Depending on grading values given in Table III.)

(b) *Definitions.* (1) "ASTM C 136" means ASTM Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates.

(2) "ASTM C 520" means ASTM Standard Test Method for Density of Granular Loose-Fill Insulation.

(c) *Physical requirements*—(1) *Thermal resistance.* Vermiculite thermal insulation shall have a thermal resistance (R-value) for a mean temperature of 24° C (75° F) of not less than 2.0 ft²-hr-°F/Btu per inch thickness. This shall be verified by testing in accordance with paragraph (d)(1) of this section.

(2) *Combustibility.* When tested in accordance with the method described in paragraph (d)(2) of this section, vermiculite shall not spark or ignite.

(3) *Water repellency.* When tested in accordance with the method described in paragraph (d)(3) of this section, vermiculite shall repel 175 ml of water.

(4) *Density.* The two types of vermiculite insulation shall have densities within the ranges specified in Table III. This shall be verified by testing in accordance with paragraph (d)(4) of this section.

TABLE III

| | Density Kg/m³ (lb/ft³) | |
|---|---|---|
| | Minimum | Maximum |
| Size designation: | | |
| Type 1 | 56 (3.5) | 112 (7.0) |
| Type 2 | 64 (4.0) | 128 (8.0) |

(5) *Grading.* The two types of vermiculite insulation shall be graded according to the value listed in Table IV. This shall be verified by testing in accordance with paragraph (d)(5) of this section.

TABLE IV.—*Grading Values*

[Accumulative Percentages (by Weight) Retained on Sieves Having Square Holes]

| Size designation | ⅜ in. (9.51mm) | | No. 4 (4.76mm) | | No. 8 (2.38mm) | | No. 16 (1.19mm) | | No. 30 (595 μm) | | No. 50 (297 μm) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | min | max | min | max | min | max | min | max | min | max | min | max |
| Type 1 | 0 | 40 | 30 | 90 | 65 | 98 | 85 | 100 | | | | |
| Type 2 | | | 0 | 5 | 20 | 80 | 75 | 99 | 90 | 100 | 97 | 100 |

(d) *Test methods*—(1) *Test method for thermal resistance.* The thermal resistance of vermiculite insulation shall be determined in accordance with ASTM C 177, C 236 or C 518.

(2) *Test method for combustibility.* Hold the vermiculite sample in a suitable fixture and position it in direct contact with the flame of a Bunsen burner for 13 seconds. Ascertain whether there is any sparking or ignition.

(3) *Test method for water repellency*—(i) *Apparatus.* A rigid plastic tube, 5.1 cm (2 in.) inner diameter, 30.5 cm (12 in.) long, with a 16 mesh plastic screen covering firmly fastened to the bottom end, and marked 19.6 cm (7.7 in.) from the screen covered end, a large rubber stopper, a 500 ml glass beaker, and a 500 ml graduated cylinder.

(ii) Fill the tube with vermiculite insulation up to the 19.6 cm mark. Compact the insulation by dropping the tube from a height of 8 cm (approx. 3.2 in.) onto the rubber stopper ten times. Add sufficient insulation to keep the tube filled to within 1 cm of the 19.6 cm mark.

(iii) With the tube supported vertically above the empty beaker, rapidly pour 250 ml of water into the tube. Allow three minutes for the water to drain through the specimen, then tilt the tube 45° to drain water collected on the screen.

(iv) Measure the volume of water collected in the beaker, and record. Repeat this test for three samples. Ascertain whether the arithmetic average of the three measurements is less than 175 ml.

(4) *Test method for density.* The density of vermiculite insulation shall be determined in accordance with ASTM C 520.

(5) *Test method for grading.* The size of vermiculite shall be determined in accordance with ASTM C 136.

**§ 456.807 Standards for perlite thermal insulation.**

(a) *Scope.* This section applies to loose-fill perlite thermal insulation.

(b) *Definitions.* (1) "ASTM C 136" means ASTM Standard Method for Sieve or Screen Analysis of Fine and Coarse Aggregates.

(2) "ASTM C 520" means ASTM Standard Method of Test for Density of Granular Loose-Fill Insulation.

(c) *Physical requirements*—(1) *Thermal resistance.* Loose-fill perlite insulation shall have a thermal resistance (R-value), for a mean temperature of 24° C (75° F), of not less than 2.6 $ft^2$-hr-°F/Btu per inch thickness. This shall be verified by testing in accordance with the test method described in paragraph (d)(1) of this section.

(2) *Water repellency.* When tested in accordance with the method described in paragraph (d)(2), of this section, perlite insulation shall repel 175 ml of water.

(3) *Density.* Perlite insulation shall have a density of not less than 80.1 $Kg/m^3$ (5 $lb/ft^3$), nor more than 128.1 $Kg/m^3$ (8 $lb/ft^3$). This shall be verified by testing in accordance with the test method described in paragraph (d)(3) of this section.

(4) *Solvent solubles.* Perlite insulation shall contain not more than 0.1 percent by weight of solvent solubles. This shall be verified by testing in accordance with the test method described in paragraph (d)(4) of this section.

(5) *Grading.* Particle size of perlite insulation shall be graded so that a minimum of 20 percent by weight of a sample is retained by a No. 16 (1.18 mm) sieve, and a minimum of 90 percent (cumulative) is retained by a No. 100 (150 μm) sieve. This shall be verified by testing in accordance with the test method described in paragraph (d)(5) of this section.

(6) *Combustibility.* When tested in accordance with paragraph (d)(5) of this section, perlite shall not spark, burn, or smoke.

(d) *Test methods*—(1) *Test method for thermal resistance.* Thermal resistance of perlite shall be determined in accordance with ASTM C 177, C 236 or C 518.

(2) *Test method for water repellency.* See § 456.806(d)(3).

(3) *Test method for density.* Density of perlite shall be determined in accordance with ASTM C 520.

(4) *Test method for solvent solubles.* Place 10 g of perlite in a tared beaker. Weigh the perlite and beaker to 0.001 g. Add 100 $cm^3$ of trichloroethane (O-T-620). Stir for three minutes, then filter through a Whatman 42 paper filter into a tared beaker. Evaporate the trichloroethane in a steam bath. Heat beaker in an oven for 30 minutes at 105° ± 2°C. Cool in a desiccator. Weigh the beaker and residue to 0.001 g, calculate weight of the residue. Ascertain whether the weight of the residue is greater than 0.1 percent of the weight of the perlite sample.

(5) *Test method for grading.* Particle size grading of perlite insulation shall be determined in accordance with ASTM C 136 with the following modification: if a mechanical sieving device is used, the sieving time shall be five minutes and the test sample shall be 50 g.

(6) *Test method for combustibility.* Hold the perlite specimen in a suitable fixture and position it in direct contact with the flame of a Bunsen burner for 15 seconds. Ascertain whether there is evidence of sparking, burning, or smoke.

**§ 456.808 Standards for Polystyrene Thermal Insulation Board.**

(a) *Scope.* This section covers cellular polystyrene thermal insulation board used in applications that range up to 74°C (165°F). Polystyrene thermal insulation board is limited to application in enclosed spaces protected by a layer of gypsum board of 12.5 mm (0.5 inch) thickness or greater, or an equivalent fire barrier. Three types of polystyrene insulation board are distinguished by density (see paragraph (c)(3) of this section).

(b) *Definitions* (1) "Cellular Polystyrene Thermal Insulation" is an organic foam composed principally of polymerized styrene resin processed to form a homogeneous rigid mass of closed cells.

(2) "ASTM C 203" means ASTM Standard Test Method for Breaking Load and Calculated Flexural Strength of Preformed Block-Type Thermal Insulation.

(3) "ASTM C 272" means ASTM Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions.

(4) "ASTM C 355" means ASTM Standard Test Method for Water Vapor Transmission of Thick Materials.

(5) "ASTM D 1621" means ASTM Standard Test Method for Compression Strength of Rigid Cellular Plastics.

(6) "ASTM D 1622" means ASTM Standard Test Method for Apparent Density of Rigid Cellular Plastics.

(7) "ASTM D 2126" means ASTM Standard Test Method for Resistance of Rigid Cellular Plastics to Simulated Service Conditions.

(8) "ASTM E 171" means ASTM Standard Test Method for Standard Atmospheres for Conditioning and Testing Materials.

(c) *Physical Requirements.*(1) *Thermal resistance.* Each of the three types of polystyrene thermal insulation board shall have a thermal resistance (R-value) for a mean temperature of 24°C (75°F), as follows:

| | Minimum permissible thermal resistance per inch |
|---|---|
| Type 1 | 3.6 ft²-hr-°F/Btu |
| Type 2 | 3.7 |
| Type 3 | 4.3 |

This could be verified by testing in accordance with the test method described in paragraph (d)(1) of this section.

(2) *Fire safety*—(i) *Flame spread.* Polystyrene thermal insulation shall have a flame spread classification of no greater than 75, when tested in accordance with the test method described in paragraph (d)(2) of this section.

(ii) *Smoldering combustion.* Polystyrene thermal insulation shall not flame or show a weight loss greater than 15 percent of the initial weight when tested in accordance with § 456.803(d)(4).

(3) *Density.* The three types of polystyrene thermal insulation board shall have densities within the ranges specified in Table V, when tested in accordance with paragraph (d)(3) of this section.

TABLE V

| | Density Kg/m³ (lb/ft³) Minimum | Maximum |
|---|---|---|
| Type 1 | 13. (0.8) | 24. (1.5) |
| Type 2 | 24. (1.5) | 48. (3.0) |
| Type 3 | 48. (3.0) | 80. (5.0) |

(4) *Water absorption.* The water absorbed by Types 1, 2, and 3 polystyrene thermal insulation board shall be no greater than 2.5, 2.5 and 0.1 percent by volume respectively when tested in accordance with paragraph (d)(4) of this section.

(5) *Water vapor permeability.* The three types of polystyrene thermal insulation board shall have a water vapor permeability of not more than 2.0 perm-inch, when tested in accordance with paragraph (d)(5) of this section.

(6) *Strength.* The three types of polystyrene insulation board shall have flexural and compressive strengths no less than the values specified in Table VI, when tested in accordance with paragraph (d)(6) and (d)(7) of this section, respectively.

TABLE VI

| | Minimum flexural strength (p.s.i.) | Minimum compressive strength (p.s.i.) |
|---|---|---|
| Type 1 | 30 | 8 |
| Type 2 | 40 | 15 |
| Type 3 | 35 | 100 |

(7) *Dimensional stability.* The three types of polystyrene insulation board shall neither expand nor contract more than 2.0 percent linearly when tested in accordance with paragraph (d)(8) of this section.

(d) *Test Methods.* Test measurements shall be made on polystyrene insulation boards conditioned in accordance with ASTM E 171 unless otherwise specified.

(1) *Test method for thermal resistance.* Determine the thermal conductance of each sample using either ASTM C 177, C 518, or C 236. In case of question, ASTM C 177 shall be used to determine the thermal conductance of the standard reference materials used to calibrate the C 518 or C 236 apparatus. Take the reciprocal of each of these values and ascertain whether it is less than the R-value specified in paragraph (c)(1) of this section.

(2) *Test method for flame spread.* The flame spread classification of polystyrene insulation board shall be determined in accordance with ASTM E 84.

(3) *Test method for smoldering combustion.* See § 456.803(d)(4).

(4) *Test method for density.* The density of the board shall be determined in accordance with ASTM D 1622 except that testing for density shall be performed on the specimen to be tested for flexural strength.

(5) *Test method for water absorption.* Water absorption of polystyrene insulation board shall be tested in accordance with ASTM C 272 after the sample is immersed in water for 24 hours.

(6) *Test method for water vapor permeability.* The vapor permeability of polystyrene insulation board shall be tested in accordance with the desiccant method of ASTM C 355.

(7) *Test method for flexural strength.* The flexural strength of the board shall be determined in accordance with ASTM C 203 with the following exceptions: (i) The width shall be 75 mm (3 inches); (ii) the radii of the bearing supports shall be 9.5 mm (⅜-inch).

(8) *Test method for compressive strength.* The compressive strength of the specimen shall be determined in accordance with procedure A of ASTM D 1621 with the following exception: The compressive strength shall be determined on a 15.2 x 2.5 cm (6-inch by 1-inch) specimen with the 1-inch dimension parallel to the thickness of the insulation board and at 10 percent deflection or at the first major load deviation, whichever comes first. A major load deviation shall be construed as that point on the stess-strain curve where the stress load drops significantly below the normal stress fluctuation characteristic of the material under test.

(9) *Test method for dimensional stability.* The board shall be tested for dimensional stability in accordance with procedures B, E, and F of ASTM D 2126 with the following exceptions: (i) The specimen shall be 30.5 cm x 7.6 cm x 2.54 cm (12 inches by 3 inches by 1 inch); (ii) procedure B temperature shall be —53.9° C (minus 65° F); (iii) procedure E temperature shall be 74° C (165° F); and procedure F temperature shall be 60° C (140° F); (iv) samples shall be exposed to these conditions for 7 days.

### § 456.809 Standard for Polyurethane and Polyisocyanurate Thermal Insulation Board.

(a) *Scope.* This section applies to rigid cellular polyurethane and polyisocyanurate insulation board. This material is limited to application in enclosed spaces protected by a layer of gypsum board of 12.5 mm (0.5 in.) thickness or greater, or an equivalent fire barrier.

For the purpose of this section, polyurethane and polyisocyanurate insulation board is classified by type, class, and style. Three types of insulation board are defined as follows:

*Type I*—density 24 to 37 Kg/m³ (1.5 to 2.3 lb/ft³).

*Type II*—density 38 to 52 Kg/m³ (2.4 to 3.2 lb/ft³).

*Type III*—density 53 to 64 Kg/m³ (3.3 to 4.0 lb/ft³).

Two classes of insulation board are defined:

*Class 1*—unfaced.

*Class 2*—faced surface.

Five styles for Class 2 insulation boards with facings are defined:

*Style A*—aluminum facing on one side.

*Style B*—aluminum facing on both sides.

*Style C*—asphalt saturated roof felt on one side.

*Style D*—asphalt saturated roof membrane on both sides.

*Style E*—faced either on one or both sides with a sheet type, insulation type, or combination of facing materials.

(b) Definitions. (1) "Cellular Polyurethane and Polyisocyanurate Insulation" are organic foams composed principally of catalyzed reaction products to form a homogeneous rigid mass of cells.

(2) "Insulation Board" means a rigid thermal insulation material preformed

into rectangular units of uniform thickness and density.

(3) "ASTM C 209" means ASTM Standard Methods of Testing Insulating Board (Cellulosic Fiber), Structural and Decorative.

(4) ASTM C 355" means ASTM Standard Method of Test for Water Vapor Transmission of Thick Materials.

(5) "ASTM D 1621" means ASTM Standard Method of Test for Compressive Strength of Rigid Cellular Plastics.

(6) "ASTM D 1622" means ASTM Standard Method of Test for apparent Density of Rigid Cellular Plastics.

(c) *Physical Requirements.*—(1) *Thermal resistance.* Polyurethane and polyisocyanurate insulation boards (Class 1 boards and the inner core insulation of Class 2 boards) shall have a thermal resistance (R-value), for a mean temperature of 24°C (75°F), of not less than 7.1 $ft^2$-hr-°F/Btu per inch thickness 30 days from the date of manufacture, and not less than 5.9 $ft^2$-hr-°F/Btu per inch 90 days from the date of manufacture, when tested in accordance with the test method described in paragraph (d)(1) of this section.

(2) *Fire safety.*—(i) *Flame spread.* The flame spread classification of polyurethane and polyisocyanurate insulation board shall be no greater than 75, when tested in accordance with the test method described in paragraph (d)(2) of this section.

(ii) *Smoldering combustion.* Polyurethane and polyisocyanurate insulation board shall not flame or show a weight loss greater than 15 percent of the initial weight when tested in accordance with § 456.803 (d) (4).

(3) *Water absorption.* The water absorbed by polyurethane and polyisocyanurate insulation boards (Class 1 boards, and the inner core material of Class 2 boards) shall be no greater than 4.0 percent by volume, when tested in accordance with paragraph (d) (4) of this section.

(4) *Dimensional stability.* For Class 1 boards, and the inner core material of Class 2 boards, Polyurethane and polyisocyanurate insulations shall show no evidence of cell collapse or visible distortion in any axis, and shall show a linear change of no greater than 2.0 percent and a thickness change no greater than 10 percent, when tested in accordance with paragraph (d)(5) of this section. Insulation boards and core insulation shall show a linear change under humid aging conditions of no greater than 4.0 percent, a thickness change no greater than 5 percent, and no evidence of cell collapse or visible distortion when tested in accordance with paragraph (d)(5) of this section. Class 2 boards should not exhibit signs of delamination of facings under such conditions.

(5) *Density.* Polyurethane and polyisocyanurate insulation board shall have a density no less than 24 $Kg/m^3$ (1.5 $lb/ft^3$) and not greater than 64 $Kg/m^3$ (4.0 $lb/ft^3$). This shall be verified by testing in accordance with paragraph (d)(6) of this section. The insulation material shall be classified as Type I, II or III according to its respective density as described in Table VII:

TABLE VII

| Type | Density range, $Kg/m^3$ ($lb/ft^3$) | |
|---|---|---|
| I | 24 to 37 | (1.5 to 2.3) |
| II | 38 to 53 | (2.4 to 3.3) |
| III | 53to 64 | (3.3 to 4.0) |

(6) *Compressive strength.* Each type of Class 1 boards and the inner core insulation of Class 2 boards of polyurethane or polyisocyanurate insulations shall have a compressive strength no less than the value specified below, when tested in accordance with paragraph (d)(7) of this section.

| Type | Compressive strength (psi) |
|---|---|
| I | 16 |
| II | 35 |
| III | 50 |

(7) *Flexural strength.* Depending on the style, each type of Class 2 (faced) polyurethane or polyisocyanurate insulation board shall have flexural strength not less than the value specified in Table VIII, when tested in accordance with paragraph (d)(8) of this section.

TABLE VIII.—*Flexural Strength Per Inch of Thickness* (psi)

| | Style A | Style B | Style C | Style D |
|---|---|---|---|---|
| Type I | 45 | 60 | 80 | 90 |
| Type II | 75 | 110 | 110 | 165 |
| Type III | 135 | 180 | 165 | 240 |

(8) *Dimensional tolerances.* Polyurethane or polyisocyanurate insulation board shall conform to the following tolerances from its specified dimensions:

length: +9mm, −1.6mm (+⅜ inch, −1/16 inch)
width: (class 1) ±1.6mm (±1/16 inch), (class 2) ±3mm (±⅛ inch)
thickness: ±1.6mm (±1/16 inch)

(9) *Water vapor permeability.* Class I boards and the inner core insulation of Class 2 boards of polyurethane or polyisocyanurate insulation board shall have a water vapor permeability of not more than 3.0 perm-inch for Types I and II, and not more than 2.5 perm-inch for Type III insulation board, when tested in accordance with paragraph (d)(9) of this section.

(10) *Hole or void.* No single hole or void larger than 6mm × 6mm × 3mm (¼-inch by ¼-inch by ⅛-inch) shall be permitted on the surface. No more than 8 holes having dimensions of 3mm × 3mm (⅛-inch by ⅛-inch) or larger shall be permitted per square feet of surface area.

(11) *Crushing or depressions.* Crushings or depressions on both faced and unfaced board shall not exceed 10 percent of the original thickness on more than 20 percent of any individual board surface.

(d) *Test Methods—Conditioning and Specimen Preparation.* Test specimens shall be cut from boards which have aged at least 30 days from the time of manufacture. Unless otherwise specified, specimens shall be conditioned at 23 ±2°C (73 ±4°F) and 50 ±5 percent relative humidity for not less than 48 hr.

(1) *Test method for thermal resistance.* The thermal resistance of insulation board or inner core insulation material shall be calculated using thermal conductance values measured in accordance with either ASTM C 177 or C 518. Sample boards or inner core insulation materials as manufactured shall be separately conditioned for 30 days at 23 ± 2°C (73.4 ± 3.6°F) and 50 ± 5 percent R.H., and for 90 days at 60°C (140°F) dry heat. Tests shall be conducted on a 2.54 cm (1 inch) thick specimen at 23.9°C (75°F).

(2) *Test method for flame spread.* The flame spread classification of polyurethane and polyisocyanurate insulation board shall be determined in accordance with ASTM E 84. Specimens to be tested shall be no less than 51 mm (2 inches) thick.

(3) *Test method for smoldering combustion.* See § 456.803(d)(4).

(4) *Test method for water absorption.* The water absorption of Class 1 and 2 insulation boards and the inner core of Class 2 boards shall be determined in accordance with the water absorption test method in ASTM C 209. When Class 2, faced, insulation board is tested, the facing shall be examined for signs of delamination. Any delamination shall be cause for rejection.

(5) *Test methods for dimensional stability*—(i) *Specimen preparation.* Cut three specimens, each 30.5 cm x 30.5 cm (12 in x 12 in) which have the same thickness as the insulation board. Cut edges shall be smooth and free of cracks and dust.

(ii) *Test procedure for dimensional stability under high temperature.* Measure specimens' length, width and thickness to the nearest 0.025 mm (0.01 inch) after conditioning. Place specimens flat on an expanded metal shelf in an air circulating oven

equipped with a temperature control to maintain a 107° ± 2°C (225° ± 3.6°F) temperature. After three days, remove the specimens from the oven and condition them for at least 2 hours at temperature and humidity as specified in paragraph (d)(1) of this section. Measure the length, width and thickness to the nearest 0.25 mm (0.01 inch) and ascertain whether the percent change in any dimension is greater than 2.0 percent. Examine specimens for evidence of cell collapse or distortion in any dimension, and for signs of delamination of facings for Class 2 boards.

(iii) *Test procedure for dimensional stability under low temperature.* Follow procedure in the preceding paragraph, except that specimens are to be placed in a low temperature chamber and maintained at −40° ± 2°C (−40° ± 3.6°F) for seven days.

(iv) *Test procedure for dimensional stability under humid conditions.* Follow the test procedure for exposing, measuring, and examining specimens except that specimens are to be placed in a suitable chamber equipped with temperature and humidity controls to maintain a temperature of 60° ± 2°C (140 ± 3.6°F) and relative humidity of 90 to 100 percent during the test. Conduct the test for 28 days. Ascertain the linear change in any dimension is greater than 4.0 percent.

(6) *Test method for density.* The density of insulation board shall be determined in accordance with ASTM D 1622.

(7) *Test method for compressive strength.* The compressive strength of insulation boards and the inner core of Class 2 boards shall be measured in accordance with ASTM D 1621.

(8) *Test method for flexural strength.* The flexural strength of Class 2 (faced) insulation board shall be determined in accordance with ASTM C 203 using a moving head speed of 12.7 mm (0.5 inch) per minute.

(9) *Test method for water vapor permeability.* The water vapor permeability shall be measured in accordance with the desiccant method of ASTM C 355.

### § 456.810 Interim Standards for Urea-Formaldehyde Based Foam Insulation.

(a) *Scope.* This section applies to urea-formaldehyde based foam thermal insulation for sidewall application only.

(b) *Definitions.* (1) "ASTM D257" means ASTM Standard Method of Test for DC Resistance or Conductance of Insulating Materials.

(c) *Physical Requirements.*—(1) *Thermal resistance.* Urea-formaldehyde (UF) foam insulation shall have an effective thermal resistance of not less than 2.2 $m^2$·°C/W for a 75 mm thick sample (4.16 $ft^2$-hr-°F/Btu per in.), when tested in accordance with the test method described in paragraph (d)(2) of this section.

(2) *Surface burning characteristics.* The flame spread classification of UF foam insulation shall not exceed 25, when tested in accordance with the test method described in paragraph (d)(3) of this section.

(3) *Corrosiveness.* Under conditions specified in paragraph (d)(4) of this section, UF foam insulation shall cause no perforations in the aluminum, copper, or steel samples, and no pitting of the galvanized steel sample. When tested in accordance with paragraph (d)(4) of this section, UF foam insulation shall not cause a weight loss greater than 0.20 gm in the galvanized steel sample.

(4) *Density.* UF foam insulation shall have a density of no less than 10.4 kg/$m^3$ (.645 lb/$ft^3$), when tested in accordance with the test method specified in paragraph (d)(5) of this section.

(5) *Water absorption.* Under conditions specified in paragraph (d)(6) of this section, the water absorption of UF foam insulation shall not exceed 15 percent by volume. When tested in accordance with paragraph (d)(6) of this section, UF foam shall not absorb the droplets of methyl violet solution in less than one hour.

(6) *Free formaldehyde content.* The free formaldehyde content of the resin used in UF foam insulation shall not exceed 1.0 percent when tested in accordance with paragraph (d)(7) of this section.

(7) *Setting time.* UF foam insulation shall set in not less than 20 seconds and not more than 90 seconds when tested in accordance with paragraph (d)(8) of this section.

(8) *Volume resistivity.* The volume resistivity of fresh UF foam insulation shall be not less than 5K +-cm, when tested in accordance with paragraph (d)(9) of this section.

(9) *Water drainage.* UF foam insulation shall manifest no water leakage from a plywood cavity when tested in accordance with paragraph (d)(10) of this section.

(10) *Shrinkage during curing.* UF foam insulation shall not shrink more than 4.0 percent in any direction when subjected to the conditions specified in paragraph (d)(11) of this section.

(11) *Fungi resistance.* UF foam shall display no fungal growth and the area of fungal growth on the specimen test frame shall not exceed 10 percent of the fungal growth area on the control when subjected to the conditions specified in paragraph (d)(12) of this section.

(12) *Warning label.* The following label shall be printed on all UF resin containers:

Caution: Urea Formaldehyde Foam Insulation may release a small quantity of formaldehyde vapor. This occurrence may present a health hazard to anyone who previously has been sensitized to formaldehyde or who has a history of respiratory problems.

(13) *Additional requirements.* Manufacturers of UF foam thermal insulation shall provide training and certification of applicators of this product and shall provide installation instructions.

(d) *Test Methods.*—(1) *Preparation of specimens.* Unless otherwise specified in the test procedure, the foam shall be prepared and applied in accordance with the manufacturer's instructions. The temperature of the unreacted materials prior to foaming shall be between 15° and 32° C. Unless otherwise specified in the test procedure, specimens shall be foamed in closed cavities at ambient conditions of 23±2° C and 50±5 percent R.H.

(2) *Test method for thermal resistance*—(i) *Conditioning.* Maintain test specimens in the closed cavities in vertical position at 23±2° C and 50±5 percent relative humidity for 28 days prior to testing.

(ii) *Testing.* The laboratory value of thermal resistance shall be determined as specified in ASTM C 177, ASTM C 518 or ASTM C236, using a specimen 75+0,—1 mm thick, a mean temperature of 24° C and a mean temperature differential across the specimen of 22±3° C. In cases of dispute ASTM C177 or ASTM C236 shall be used. Specimen surfaces may be those obtained during foaming or they may be obtained by slicing the material to remove not more than 5 mm from each side.

(iii) The effective thermal resistance shall be computed as 60 percent of the laboratory thermal resistance value determined by the preceding paragraph.

(3) *Test method for surface burning characteristics.* The flame spread classification of UF foam shall be determined in accordance with ASTM E 84.

(4) *Test method for corrosiveness.*

(i) Condition the UF foam thermal insulation specimens as indicated in paragraph (d)(2) of this section.

(ii) *Apparatus and Materials.* (A) Oven capable of maintaining 50±2° C and another oven capable of maintaining 70±2° C.

(B) Small container, approximately 90×50 mm, made of inert material such as polypropylene and equipped with a lid so designed that water condensing on it will not drip, but will run to the walls of the container.

(C) Large container, capable of housing the small container, but that will fit inside the oven.

(D) Test specimens, approximately 50×50 mm by 0.0762 mm thick metal, free of tears, punctures or crimps as follows:

● 3003 Bare Aluminum, soft temper;
● ASTM B152, type ETP, Cabra No. 110, soft copper;
● Low carbon, commercial quality, cold rolled shim steel.

(E) Test specimens, section of truss plates approximately 50 × 50 mm by 1.0 mm made from hot dipped galvanized sheet steel conforming to Grade A or B, ASTM B 446 with a total zinc coating of 275−0, +31 g/m². At least 40 percent of the zinc shall be on any one side of the test specimens. Test specimens shall have at least six perforations.

(F) Trichloroethylene, analytical reagent grade.

(G) Balance, capable of determining the mass of the galvanized specimen to an accuracy of 1 mg.

(H) 40 W appliance light blub.

(I) Distilled water, nitric acid 1.002 kg/L, ammonium hydroxide (relative density 0.90), chromium trioxide, silver nitrate, hydriodic acid, reagent grade chemicals.

(J) Several noncorrosive plastic supports and a 150 g mass.

(iii) *Procedure.* Make two duplicate tests for each determination. Wash the metal specimens with trichloroethylene to remove any oil or grease. Dry at room temperature. Cut a specimen 60×60 mm square and 15 mm thick from the UF foam block such that the 60×60 mm surface is that obtained from foaming and not slicing the foam. All other surfaces of the specimen shall be obtained by slicing the foam. Compress the specimen between flat, parallel, noncorrosive plastic surfaces for 2 min at 700±7 kPa. Prepare 16 such wafers, noting which surface had been obtained form foaming. These surfaces shall be placed adjacent to the metal specimens in the tests. Weigh the galvanized specimens and record its mass. Place a noncorrosive plastic screen support in the small container. Place a foam wafer on the support at least 5 mm above the bottom of the container. Place the metal specimen on the wafer; put another wafer on the metal specimen and then place on top of the sandwich a noncorrosive plastic screen and a 150 g mass. The 150 g mass shall not block air flow to the top wafer. Cover the lid of the small container is closed but not sealed. Place the small container in the large container, add sufficient distilled water to the large container, and close the large container but do not seal it. Place the assembly in an oven at 70±2°C for 24 h. Remove the assembly from the 70°C oven, seal the large container and transfer the assembly to an oven maintained at 50±2°C. Maintain the assembly at this temperature for 27 days. Upon completion of the test remove the assembly from the oven and dismantle. The large container shall still have some water in it; if there is no water present at the end of the test, the results for those materials passing the test are suspect and the test should be repeated. Thoroughly wash the metal specimens under running water and lightly brush them to remove loose corrosive products. Remove the remaining corrosive products from the aluminum, copper and steel specimens by immersing them in a solution of 10 parts distilled water to 1 part 1.002 Kg/1 nitric acid. Remove the remaining corrosion products from the galvanized specimen by the procedure recommended in ASTM G 1 in the method for the chemical cleaning of zinc after testing. Rinse all metal specimens in distilled water and dry. Examine the aluminum, copper and steel specimens for perforations by holding them over a chrome rejected 40 W applicance light bulb. Examine the galvanized specimen for pitting and weigh the specimen and its control. The control shall be a specimen having the same number of perforations, be of the same geometric form and be from the same batch of truss plates as the specimen. The control shall not be exposed in the oven but shall be cleaned identically to the specimen. Subtract the loss in mass of the control from the loss in mass of the specimen

(5) *Test method for density.* The density of UF foam insulation shall be determined in accordance with ASTM D 1622.

(6) *Test methods for water absorption.*—(i) *Floating test.* Cut three cubes, each 180 x 180 x 90 mm from a block of foam. Accurately weigh each cube and place them singly on a distilled water surface. The surface in contact with the water shall be that obtained from foaming. After 7 days at 23 ± 2°C and 50 ± 5 percent R.H., remove the cubes and accurately weigh them. Calculate the percentage of water absorption on a volume basis.

(ii) *Droplet test.* Prepare a 0.3 percent solution of methyl violet in distilled water. Apply 5 drops, each 0.03 ml, of the solution by means of a syringe to a freshly cut horizontal surface of the foam and to a surface obtained from foaming. Measure the time required by the drops to be completely absorbed through the surface of the foam. This point in time may be ascertained under direct lighting as the moment when the areas to which the drop has been applied become dull. Perform the test at 23 ± 2°C and 50 percent R.H.

(7) *Test method for free formaldehyde content of resin.* Prepare a standard sulfite solution as follows: Dissolve, without heating, approximately 250 g $Na_2SO_3 \cdot 7_2O$ in about 200 ml distilled water. Dilute to one litre. Adjust the pH of the sulfite solution to 8.9 with $H_2SO_4$ and NaOH solutions. The solution is stable only for a short period of time and it should be used immediately after adjustment of the pH. Place 20 ml distilled water in an Erlenmeyer flask. Accurately weigh approximately 2 g resin solution (ready for foaming) and add it to the flask. Stir the mixture well, add approximately 10 g crushed ice and mix thoroughly.

Add 50.0 ml of the standard sulfite solution and titrate immediately with 0.49 g/l $H_2SO_4$ to pH 8.9. Perform the procedure in duplicate and run a blank.

Calculate the percentage formaldehyde content of the resin as follows:

percent formaldehyde = 3(A − B)D/C

Where:

A = ml of 0.49 g/l $H_2SO_4$ for the specimen
B = ml of 0.49 g/l $H_2SO_4$ for the blank
C = mass of resin solution
D = normality of the $H_2SO_4$ solution.

(8) *Test method for setting time.* A conical specimen with a bottom diameter of approximately 30 cm and a height of approximately 30 cm shall be made by foaming from a hose. Start a stopwatch immediately after the cone has been formed and immediately commence slicing the cone with a spatula. Record the time when the foam no longer slices as if it were whipped cream but shears off leaving a smooth surface. This time is the setting time.

(9) *Test method for volume resistivity.* Determine the volume resistivity of the foam as specified in ASTM D 257. Test a 90 mm cube 15 min after foaming between 90 mm square metal plate electrodes using a voltage of 110 V.

(10) *Test method for water drainage.* Prepare a cavity approximately 2440 mm high, 400 mm wide and 90 mm deep from wood and plywood. Fill the cavity by foaming in place or trowelling. Leave the cavity in a vertical position for 24 hours, during which time the bottom and underside of the structure should be examined for water. The cavity shall be built so that any free water from the foam can run out easily at the bottom.

(11) *Test method for shrinkage.* Fill three boxes, each measuring 480 × 480 × 90 mm made from unwaxed corrugated cardboard and conforming to CGSB 43-GP-21, type 1, class 1, grade C4. The boxes shall be held in a snug fitting enclosure during foaming to prevent distortion of the box. Maintain the cavities in a vertical position for 28 days at 23±2° C and 50±5 percent R.H. Then open the cavities and measure the linear shrinkage in the two principal directions. Report the average of all six determinations as the linear shrinkage. If fractures in the specimens occur, the data should be discounted and the test repeated.

(12) *Test method for fungi resistance.* Prepare two test frames, measuring 480 × 480 × 90 mm from Douglas fir plywood and white spruce. Submerge the test frames in tap water for 48 h. Remove the test frames and dry the surface with paper towels. Drill a hole in one test frame and foam in the material under test. Maintain the two test frames in a vertical position for 28 days at 23±2° C and 50±5 percent R.H. Then open up the both test frames, remove and examine the cured foam. Determine the area of fungi growth in the control and in the specimen test frame.

**§ 456.811 Standards for aluminum foil reflective thermal insulation.**

(a) *Scope.* This section applies to aluminum reflective thermal insulation. Four classes of aluminum foil reflective thermal insulation are defined. They are:

(1) Class 1—One reflective air space.

(2) Class 2—Two reflective air spaces.

(3) Class 3—Three reflective air spaces.

(4) Class 4—Four reflective air spaces.

(b) *Definitions.* (1) "ASTM C 445" means ASTM Standard Test Method for Normal Total Emittance of Surface of Materials .01 Inch or Less in Thickness at Approximately Room Temperature.

(2) "ASTM D585" means ASTM Standard Method of Sampling and Accepting a Single Lot of Paper, Paperboard, Fiberboard or Related Product.

(3) "Emittance" means the ability of an opaque material to emit radiant energy.

(c) *Physical requirements.*—(1) *Thermal resistance.* Depending on the direction of heat flow the four classes of aluminum foil reflective thermal insulation shall have values of thermal resistance (R-values) measured in $ft^2$-hr-°F/Btu not less than the values specified in Table IX when tested in accordance with paragraph (d)(1) of this section.

TABLE IX.—*Minimum R-Values*

| Class | Direction of heat flow | | |
|---|---|---|---|
| | Up | Horizontal | Down |
| 1 | 1.7 | 2.8 | 3.0 |
| 2 | 3.0 | 4.7 | 5.5 |
| 3 | 5.7 | 6.5 | 8.0 |
| 4 | 7.0 | 7.8 | 11.0 |

(2) *Foil.* The foil used in insulation shall contain not less than 99 percent aluminum by weight.

(3) *Kraft paper.* Kraft paper used in aluminum foil insulation shall meet the requirements of ASTM D 858.

(4) *Adhesive.* Adhesive used in bonding aluminum foil insulation shall be waterproof material and shall show no sign of bleeding or delamination when tested in accordance with the test method described in paragraph (d)(2) of this section.

(5) *Thickness.* Layers of insulation composed of unsupported foil that is exposed shall have a minimum thickness of 0.010 mm (0.0004 inch). Unsupported foil that is sandwiched in a multilayer sheet shall have a minimum thickness of 0.009 mm (0.00035 inch). Foil bonded to Kraft paper shall have a minimum thickness of 0.00025 inch.

(6) *Emittance.* The foil shall be an emittance of not more than 0.05 when tested in accordance with the test method described in paragraph (d)(3) of this section.

(7) *Water vapor permeance.* All classes of the aluminum foil insulation shall have a water vapor permeance not greater than 1.0 perm for a vapor pressure differential of 25 mm (1 in.) of mercury when tested in accordance with the test method described in paragraph (d)(4) of this section.

(8) *Pliability.* Aluminum foil insulation shall not crack when folded to 180° bend at a temperature of 21°±1.1° C (70±2° F) and a relative humidity of 50±5 percent.

(9) *Finished insulation.* Layers shall be securely bonded together along edges, forming an attachment flap suitable for nailing or stapling.

(i) *Class 1.* Insulation shall be designed to be installed so that the reflective surface is parallel to, and a minimum of 19. mm (¾ inch) from the opposite face of the air space.

(ii) *Class 2.* Insulation shall be designed to be installed so that the reflective surfaces are parallel to, and a minimum of 19. mm (¾ inch) from the opposite faces of the two air spaces.

(iii) *Class 3.* Insulation shall be designed to be installed so that full separation of layers occur and the reflective surfaces are parallel to, and a minimum of 19, mm (¾ inch) from the opposite faces of the three air spaces.

(iv) *Class 4.* Insulation shall be designed to be installed so that full separation of layers occur and the reflective surfaces are parallel to, and a minimum of 19. mm (¾ inch) from the opposite faces of the four air spaces.

(d) *Test methods.*—(1) *Test method for thermal resistance.* Thermal resistance of aluminum foil thermal insulation shall be calculated by measuring thermal conductance in accordance with ASTM C 236.

(2) *Test method for adhesive.* Specimens for tests shall consist of pieces of aluminum foil insulation cut to approximately 76 by 152 mm (3 by 6 inches) in size. Suspend specimens in vertical position and heat to a temperature of 82° C±2.8° C (18° F±5° F) for at least five hours. At the end of heating period, examine the reflective surfaces to determine whether the adhesive had bled or exuded through the surface, or if delamination has occurred.

(3) *Test method for emittance.* Emittance of aluminum foil insulation shall be measured in accordance with ASTM C 445.

(4) *Test method for water vapor permeance.* Water vapor permeance of aluminum foil insulation shall be measured in accordance with ASTM E 96, procedure A.

**§ 456.812 Standards for storm windows, storm and thermal doors, caulks and sealants, clock thermostats, water heater and heating/air conditioning duct insulation.**

(a) *Scope.* This section applies to the following materials or components thereof:

(1) Storm windows (aluminum combination, aluminum, wood, or rigid vinyl frame).

(2) Storm and thermal doors (aluminum, frame, wood, thermal or rigid vinyl frame).

(3) Caulks and sealants.

(4) Clock thermostats.

(5) Water heater and heating/air conditioning duct insulation.

(b) *Definitions.* (1) "ANSI" means American National Standards Institute.

(2) "AAMA" means Architectural Aluminum Manufacturers Association.

(3) "NWMA" means National Woodwork Manufacturers Association.

(4) "NBS/PS" means National Bureau of Standards Voluntary Product Standard.

(5) "F.S." means Federal Specification.

(6) "F.H.D.A." means Fir and Hemlock Door Association.

(7) "NEMA" means National Electrical Manufacturers Association.

(8) "SDI" means Steel Door Institute.

(9) "SWI" means Steel Window Institute.

(10) "CPSC" means Consumer Product Safety Commission.

(c) *Material and product standards*—(1) *Storm windows.* (i) Aluminum combination storm windows shall conform to ANSI/AAMA 1002.9-1977, "Voluntary Specification for aluminum Combination Storm Windows for External Applications." Aluminum frame storm windows shall conform to Sections Cl.2, Cl.3, Cl.4 and Cl.6 of ANSI/AAMA 1002.9-1977.

(ii) Wood frame storm windows shall conform to Section 3 of ANSI/NWMA I.S. 2-73, "Industry Standard for Wood Storm Windows."

(iii) Rigid vinyl frame storm and thermal windows shall be constructed

with vinyl profile extrustions which conform to NBS/PS26-70, "Rigid Polyvinyl-Chloride Profile Extrusions."

(2) *Storm and thermal doors.* (i) Aluminum frame storm doors shall conform to ANSI/AAMA 1102.7-1977, "Voluntary Specifications for Aluminum Storm Doors."

(ii) Pine storm and thermal doors shall conform to the requirements for exterior doors listed in Section 3 of ANSI/NWMA I.S. 5-73, entitled "Ponderosa Pine Doors."

(iii) Fir, hemlock, and spruce storm and thermal doors shall conform to the requirements for exterior doors listed in Section 3 of FHDA 6-77, "Industry Standard for Douglas Fir, Western Hemlock, and Sitka Spruce Doors and Blinds".

(iv) Rigid vinyl frame storm and thermal doors shall be constructed with vinyl profile extrusions which conform to NBS/PS 26-70.

(v) If storm or thermal doors contain glazing, safety glazing shall conform to CPSC safety standard Part 1201-"Safety Standard for Architectural Glazing Materials."

(3) *Caulks and sealants.* Caulks and sealants shall conform to the applicable Federal Specifications and ASTM standards indicated in table X:

TABLE X

| Type of caulk or sealant | Applicable specification |
|---|---|
| Putty | F.S. TT-P-00791B—modified to allow natural calcium carbonate. |
| Oil and Resin Base | F.S. TT-C-00598C and ASTM C-570-72. |
| Acrylic (Solvent type) | F.S. TT-S-00230C. |
| Butyl Rubber | F.S. TT-S-001657. |
| Chlorosulphonated Polyethylene. | F.S. TT-S-00230C. |
| Latex Sealing Compound | ASTM C 834-76. |
| Polysulfide—single component. | F.S. TT-S-00230C. |
| Polysulfice—multicomponent. | F.S. TT-S-00227E. |
| Polyurethane—single component. | F.S. TT-S-00230C. |
| Polyurethane—multicomponent. | F.S. TT-S-00227E. |
| Silicone | F.S. TT-S-001543A. |

(4) *Clock thermostats.* The thermostat portion of clock thermostats shall conform to NEMA DC 3-1978 "Low-voltage Room Thermostats," and NEMA DC 15-1972 "Residential controls: Line-voltage Room Thermostats," and shall meet the following requirements:

(i) The operating differential shall not exceed 1.11° C (2° F),

(ii) The cycling rate at 50 percent maximum load shall not exceed six cycles per hour, and

(iii) The effective operating droop shall not exceed 2.2° C (4° F).

(5) Water heater and heating/air conditioning duct insulation shall conform to F.S. HH-I-558, "Federal Specification of Mineral Fiber Batts and Blankets—Industrial Type."

**§ 456.813 Standards for aspects of multiglazed insulating glass units for windows and doors.**

(a) *Scope.* This section applies to sealed multiglazed insulating glass units for use in windows and doors. Two types of multiglazed insulating glass units are (1) glass edge type, and (2) organically sealed type.

(b) *Definition.* (1) "Sealed insulating glass unit" means a preassembled unit, comprising sealed panes of glass separated by dehydrated space(s), intended for windows and doors.

(2) "Frost point" means the temperature at which visible frost begins to deposit on the interior air space glass surface of a sealed insulating glass unit in contact with the measuring surface of the frost point apparatus.

(3) "ASTM E576-76" means American Society for Testing and Materials Standard Test Method for Dew/Frost Point of Sealed Insulating Glass Units in Vertical Position.

(c) *Physical properties.* (1) The organic seal for multiglazed insulating glass units must pass the following tests:

(i) The frost point of each test specimen shall be no higher than −28.9° C (−20° F) when tested in accordance with the method described in paragraph (d)(2) of this section.

(ii) No fog shall be visible on either of two test speciments after testing in accordance with the method described in paragraph (d)(3) of this section.

(2) Sealed multiglazed insulating glass units when used in doors shall conform to CPSC safety standard Part 1201—"Safety Standard for Architectural Glazing Materials."

(d) *Test methods.*—(1) *Specimen preparation.* (i) Each test specimen shall measure 356±6 mm by 508±6 mm (14±¼ in. by 20±¼ in.) and shall be composed of two panes of transparent glass each having a thickness of 4.8 mm (3/16 in.). The nominal air space thickness shall be 6.4 mm (¼ in.).

(ii) The test specimens shall be preassembled and sealed with organic sealant.

(2) The frost point of sealed insulating glass units shall be measured in accordance with ASTM E 576-76. Six specimens shall be tested.

(3) *Test method for fogging.*—(i) *Apparatus:* (A) A copper tubing cooling plate approximately 127 mm (5 in.) square. The temperature of the cooling plate shall be 21±3° C (70±5° F).

(B) Ultraviolet light source, 275 W, type RS sunlamp or equivalent, having an output of not less than 2 mw/cm² when tested at the distance needed to maintain the specimen glass surface temperature at 66±3° C (150±5° F).

(ii) *Preparation of test specimens.* (A) Mount two specimens in a frame that is positioned vertically.

(B) Remove from a corner of the specimen on one side of the glass the metal edging, banding tape or other covering so as to expose 76 mm (3 in.) of glass periphery on two adjacent edges. The corner so exposed shall be on the side of the specimen exposed to ultraviolet light source.

(C) Place the ultraviolet light perpendicular to the glass surface with the lamp aligned to the corner so as to maintain a temperature of 66±3°C (1500±5° F) as measured by a thermocouple which is taped to the glass surface.

(iii) *Test procedure.* (A) Place the copper tubing cooling plate on the center of the back side of the >specimen.

(B) Turn on the ultraviolet light source and maintain the glass surface temperature at 66±3°C (1500±5° F) by adjusting the distance of the light.

(C) Expose each specimen continuously for one week.

(D) Remove the specimen from the test and examine after 24 hours at room temperature. Ascertain whether either specimen shows fogging.

**§ 456.814 Standards for furnace efficiency modifications.**

(a) *Scope.* This section applies to the following furnace efficiency modifications:

(1) Replacement gas-fired central furnaces.

(2) Replacement oil-filed central furnaces.

(3) Heat Pumps.

(4) Replacement oil burners.

(5) Electrically operated vent dampers for gas furnaces.

(6) Mechanically actuated vent dampers for gas furnaces.

(7) Thermally actuated vent dampers for gas furnaces.

(8) Electrically operated vent or chimney connector dampers for oil-fired furnaces.

(9) Automatic gas ignition systems.

(b) *Product standards.*—(1) *Standard for replacement gas-fired central furnaces.* Gasfired central furnaces shall conform to ANSI Z21.47-1978, entitled "American National Standard for Gas-fired Central Furnaces," ANSI Z21.15-1977, entitled "Gas-Fired, Low Pressure Steam and Hot Water Heating Boilers," or ANSI Z21.59-1974, "Gas-Fired High Pressure Steam and Hot Water Heating Boilers."

(2) *Standard for replacement oil burners.* Oil burners shall conform to ANSI Z96.2-1974/UL-296, entitled "Oil Burners" and ANSI Z91.2-1976, entitled "Performance Requirements for Automatic Pressure Atomizing Oil Burners of the Mechanical—Draft Type".

(3) *Heat pumps.* Heat pumps shall conform to UL 559 "Standard for Heat Pumps."

(4) *Standard for electrically operated vent dampers on gas furnaces.** Electrically operated vent dampers on gas furnaces shall conform to ANSI Z21.66–1977, entitled "American National Standard for Electrically Operated Automatic Vent Damper Devices for Use with Gas-Fired Appliances".

(5) *Standards for mechanically actuated vent dampers on gas furnances.** Mechanically actuated vent dampers on gas furnaces shall conform to ANSI Z21.67–1979, entitled "Amercian National Standard for Mechanically Actuated Automatic Vent Damper Devices for Use with Gas-Fired Appliances".

(6) *Standard for thermally actuated dampers on gas furnaces.** Thermally actuated vent dampers on gas furnaces shall conform to ANSI Z21.68–1979, entitled "American National Standard for Thermally Actuated Automatic Vent Damper Devices for Use with Gas-Fired Appliances".

(7) *Standard for vent dampers on oil-fired furnaces.** Vent dampers on oil-fired furnaces shall conform to UL17, entitled "The Proposed First Edition of the Standard for Vent or Chimney Connector Dampers for Oil-Fired Appliances".

(8) *Standard for automatic gas ignition system.** Automatic gas ignition systems shall conform to ANSI Z21.20–1975, entitled "American National Standard for Automatic Gas Ignition Systems and Components"

**§ 456.815 Load management devices.**

(a) *Scope.* This section applies to devices associated with load management techniques. Application of load management technology in the United States is expected to expand rapidly. Consensus specifications for load management devices are likely to become available in the future as their use becomes more common.

(1) *General.* (i) It shall be suitable for its intended purpose.

(ii) Claims of its performance shall be substantiated by certified test data on production models.

(iii) It shall have UL approval.

(iv) It shall not be incompatible with the utility's control equipment, where relevant.

(v) It shall be constructed of substantial and compatible materials.

(vi) Where required for safety, warning decals, safety locking, and automatic shut-off devices shall be used.

(vii) It shall not cause improper functioning of other household appliances.

(2) The manufacturers shall maintain a suitable quality control program to ensure that all component parts, as well as the finished product, will conform to all of the manufacturer's efficiency, performance, and safety claims.

(3) The manufacturer shall provide detailed installation and general maintenance instructions with each unit.

(4) The manufacturer shall provide a warranty for the device which covers a period of at least 3 years.

**Subpart I—Energy Conservation Installation Standards**

**§ 456.901 Scope.**

This subpart contains the installation standards, referred to herein as standards practices, for the safe and effective installation of energy conservation measures.

The standard practices of this Subpart contain references to existing ASTM (American Society for Testing and Materials) and ANSI (American National Standards Institute) standards. These references are listed in Appendix A of this subpart.

**§ 456.902 Definitions.**

(a) Certain technical terms relating to insulation not defined below are used in this subpart in accordance with the definitions given in ASTM Designation C–168–67, "Standard Definitions of Terms Relating to Thermal Insulating Materials."

(b) As used in this subpart—

(1) "Approved" means acceptable to whatever authority regulates the installation procedures discussed in this practice. Such authority is usually a municipal, state, or federal agency or an underwriters' inspection or rating bureau.

(2) "Circuit" means the complete path about which an electric current travels.

(3) "Class 2 Thermostat Circuit" means the circuit by which a thermostat constrols a heating and/or cooling unit which is characterized by limits involving current and/or voltage. Transformers supplying Class 2 thermostat circuits are marked as such (see Article 725 of the National Electric Code, 1978 Edition, Pages 546 to 554).

(4) "Conditioned Space" means any space in a residential building which is served by a heating or cooling system.

(5) "Draft Hood" means a component of gas-fired water heaters which mixes secondary air with the combustion gases leaving the unit thus enabling a smooth, continuous relief of gases up the flue pipe.

(6) "Draft Regulator" means a component of oil-fired water heaters which mixes secondary air with the combustion gases leaving the unit thus enabling a smooth, continuous relief of gases up the flue pipe.

(7) "Flue Damper" means a device which automatically closes flues on oil and gas-fired water heaters to prevent the escape of heat through the flue pipe when the water heater's main burner is not being fired. This device also may be called a vent damper.

(8) "Flue Pipe" means an exhaust pipe carrying products of combustion from oil-fired and gas-fired water heaters to the outside environment.

(9) "Galvanic Corrosion" means a form of deterioration resulting from the electrochemical reaction that occurs when certain dissimilar metals are in contact.

(10) "Hi-Limit Switch" means a temperature control that senses temperature changes in electric, gas, and oil-fired water heaters and cuts off the energy supply or fuel flow to the unit when the internal water temperature rises above a certain point.

(11) "Mastic" means a pasty material used as an adhesive for installing insulation board.

(12) "Mineral Cellular Loose-fill Thermal Insulating Materials" means mineral particulate material in granular, modular, powdery, or similar form designed to be installed dry by pouring, blowing, or hand placement between retaining surfaces or as a covering layer.

(13) "Mineral Fiber Batt and Blanket Thermal Insulating Materials" means a flexible thermal insulation that can readily be conformed to curved or irregular surfaces, suitably bound together to provide units of substantial area for handling and application, which may be faced or reinforced with confining media.

(14) "Mineral fiber Loose-fill Thermal Insulating Material" means particulate material in fibrous form designed to be installed dry by pouring, blowing, or hand placement between retaining surfaces or as a covering layer.

(15) "Multi-glazing" means an arrangement of two or more separated layers of glazing (providing one or more insulating air spaces). Multi-glazing can be achieved by installing a preassembled, sealed insulating glass unit or by affixing one or more additional sheets of glazing onto an existing window, sash or glass.

(16) "Oil Burner" means a device which, for oil-fired heating equipment in a residential building, atomizes, vaporizes, or otherwise disperses the fuel oil, mixes it with air and ignites the fuel-air mixture, and is an integral part of an oil-fired furnace or boiler, including the combustion chamber.

(17) "Organic Cellular Rigid Board Thermal Insulation" means rigid or semirigid thermal insulation preformed into rectangualr units.

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* NOTE.—All vent dampers and automatic gas ignition devices (paragraphs (4)–(8) above) shall contain a label stating: "This device should be installed by an approved contractor."

(18) "Organic (Cellulosic or wood fiber) Loose-fill Thermal Insulating Materials" means organic particulate material in granular, modular, powdery, or similar form designed to be installed dry by pouring, blowing, or hand placement between retaining surfaces or as a covering layer.

(19) "Pressure Relief Value" means a safety valve which opens to vent pressure when the pressure in the water tank exceeds a pre-set level due to excessive water temperature.

(20) "Prime Window (door)" means the original window (door) to which a storm window (door) or multi-glazing is added to provide greater thermal resistance.

(21) "Reflective Thermal Insulation" means thermal insulation depending for its efficiency in large part on reduction of radiant heat transfer across spaces by use of one or more surfaces of high reflectance and low emittance.

(22) "Replacement Oil Burner" means an oil burner that conforms to the requirements of the most recent revisions of American National Standard Safety Standard for Oil Burners, Z96.2–1974 (UL 296–September 1974) and American National Standard Performance Requirements for Automatic Pressure Atomizing Oil Burners of the Mechanical Draft Type, Z91.2–1976 and approved by a nationally recognized testing agency.

(23) "Storm Door" means a door installed outside or inside a prime door, creating an insulating air space to provide greater resistance to heat flow than the prime door alone.

(24) "Storm Window" means a unit consisting of glazing installed in a window opening either outside or inside a prime window, creating an insulating air space to provide greater resistance to heat flow than the prime window alone. The storm window may be removable or permanently attached.

(25) "Thermal Door" means a unit installed in a door opening which has an R-value of at least two and is weatherstripped to provide greater resistance to heat flow.

(26) "Thermal Window" means a window system with improved thermal performance through the use of multiple glazing and more airtight construction. Some thermal windows also provide an insulating frame and sash to provide greater thermal efficiency.

(27) "Unconditioned Space" means any space, out-of-doors or in a residential building, which is not served by a heating or cooling system.

(28) "Unit" means a storm window, thermal window, multi-glazing or storm door as defined herein. It is a manufactured item assembled in a factory or a knock down unit assembled at the site prior to installation.

(29) "Vapor Barrier" means any material (as defined in ASTM Designation C–755–73) that has a water vapor permeance (perm) rating of one (1) or less.

NOTE 1. The following materials, upon proper application, constitute vapor barriers: Asphalt impregnated kraft paper, aluminum foil, plastic film, and paint and wallcoverings which are labeled by the manufacturer as having a perm rating of one (1) or less when applied in accordance with the manufacturer's instructions.

(30) "Water Heater Thermal Insulating Materials" means mineral fiber jacket with a non-combustible facing material to insulate hot water heaters.

**§ 456.903 Coverage and additional requirements.**

(a) *Coverage.* This Subpart shall apply to all installation contractors who appear on the list of contractors prepared by the State pursuant to § 456.312 under the circumstances described in the State Plan pursuant to § 456.305.

(b) *Additional requirements.* (1) The installation practices in this Subpart contain certain "recommendations" regarding the application of vapor barriers in some condensation zones. The term "recommend" is used to signify that the procedures identified are not required to provide a safe and effective installation of insulation in every instance but may prevent the occurence of moisture problems under certain conditions. The eligible customer ultimately needs to accept or reject the "recommended" practices contained herein. Therefore, whenever a "recommendation" is contained in these practices, the person responsible for the installation shall present to the eligible customer the "recommendation" and any additional information which he can provide to assist the eligible customer in making a decision.

(2) At the completion of each installation of thermal insulation materials covered under §§ 456.904–456.908, the person responsible for such installation shall comply with the requirements of § 456.909, "Certification Procedures for the Installation of Thermal Insulation Materials."

**§ 456.904 Standard Practice for the Installation of Organic and Mineral Fiber Loose-Fill Thermal Insulation.**

(a) *Scope.* (1) This practice covers the installation of organic (cellulosic or wood) and mineral (rock, slag, or glass) fiber loose-fill thermal insulation on ceilings, attics, floors and in frame wall cavities.

(2) This practice applies only to the installation of dry loose-fill thermal insulation consisting of organic or mineral fiber materials by pneumatic or manual means. It does not apply to material installed in a wet condition or where liquid is added at any stage of the installtion process.

(3) This practice covers the installation process from pre-installation inspection through post-installation inspection. It does not cover the production of the insulation materials, whether such production takes place in a factory or at the installation site.

(4) This practice is not intended to replace the manufacturer's installation instructions unless they are inconsistent with this practice.

(5) This practice is not intended to supersede the authority of state and local codes and regulations unless the requirements of such codes and regultions are less stringent than those prescribed herein.

(6) This practice requires that the person installing the insulation have a working knowledge of the applicable codes and regultions, tools, equipment, and methods necessary for the installation of thermal insulation materials or, in the alternative, that the person supervising the installer have such knowledge. It also requires an understanding of the fundamentals of residential construction that affect the installation of insulation.

(7) This practice covers aspects of installation relating to the effectiveness, durability, and safety of insulation in service.

(8) This practice provides minimum requirements that will help to ensure the installation of insulation in a safe and effective manner. Actual conditions in existing buildings vary greatly and in some cases substantial additional care and precaution may have to be taken to ensure effective and safe installation.

(b) *Significance.* (1) This practice recognizes that effectiveness, safety, and durability of insulation depend not only on the quality of the insulating materials, but also on their proper and workmanlike installation.

(2) Improper installation of insulation may reduce its thermal effectiveness, cause fire hazards and other unsafe conditions, and promote the deterioration of the structure in which it is installed.

NOTE 1.—Specific hazards that can result from improper installation include:

a. deterioration or failure of electrical wiring components and heat buildup caused by overfused electrical circuits or by exposed metal wire conductors, when wiring is encapsulated in thermal insulation;

b. fire caused by heat buildup from recessed lighting fixtures covered by insulation;

c. flame spread on exposed flammable vapor barriers; and

d. deteriortion of wood structures, paint failures, and corrosion of metal fasteners and electrial components caused by prolonged moisture accumulation within building components.

(c) *Safety Precautions.* During installation, do not smoke or carry any open flame in the attic or any truck or van used for installation.

(d) *Pre-installation Inspection and Preparation*—(1) *General.* (i) Identify all recessed lighting fixtures (including wiring compartments and ballasts), motors, fans, blowers, heaters, furnaces, flues, chimneys, and other heat-producing divices in all areas where insulation is to be installed.

(ii) Install blocking, such as wood, metal, unfaced mineral wool batts, or non-flammable rigid cardboard around items identified in paragraph (d)(1)(i) of this section to permanently maintain a 3-inch minimum airspace all around them. Install blocking at least as high as the height of the finished insulation. Do not cover recessed lighting fixture enclosures, or their wiring compartments and ballasts, so as to entrap heat and prevent the free circulation of air unless the fixture(s) are otherwise approved for the purpose. If mineral fiber is installed, the blocking and airspace specified in this section need not be provided around flues and chimneys.

(iii) Install necessary blocking so that all devices which may require maintenance or servicing remain accessible after the insulation is installed.

(iv) Inspect the siding, roof, walls, ceilings, and attic floors to identify areas where a previous moisture problem has caused paint peeling, warpage, stain, fungus growth, rotting, or other structural damage. Do not install insulation in such areas unless these conditions and their source(s) have been corrected.

(v) Block all openings in ceilings, floors, and sidewalls through which the insulating material may escape. Seal all wall cavities which open into a basement or crawl space before wall insulation is installed.

(vi) Determine the structural soundness and strength of walls or ceilings. Do not install insulation in areas too weak to withstand the pressures or loads created by the filling process unless such condition has been corrected.

(2) *Walls.* (i) Inspect walls to determine whether insualtion was installed previously. Do not install additional insulation where there is existing insulation in wall cavities.

(ii) For buildings located in Zone I of Figure 1, provide a vapor barrier on the interior surface of all bathrooms and unvented kitchens and laundary areas. Caulk or seal all major cracks in the exterior walls of these rooms including joints between the floor and wall (except where impractical because of carpeting), between wall and ceiling, at joints around window frames, and around wall penetrations for electrical services (outlets and switches), plumbing stacks, and heating and air conditioning ducts.

NOTE 2.—It is *recommended* that a vapor barrier and caulking, such as described in this section, also be provided in the buildings in Zone II of Figure 1.

Figure 1. Condensation Zones in the United States

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NOTE 3.—The above requirements for moisture control are minimum requirements needed to prevent long-term moisture damage. Homes which are characterized by one or more of the following are more likely to experience excessive moisture accumulation which can be corrected by application of a vapor barrier and caulking as described above and/or additional venting of the wall cavity from the exterior or by additional ventilation of the occupied space.

a. Homes with an area of less than 800 square feet,

b. Homes with less than 250 square feet per occupant,

c. Homes with tight wall and ceiling construction and weatherstripped windows and doors,

d. Electrically heated homes or homes with a heating system which uses outside combustion air.

A relative humidity indicator may be installed to monitor the humidity level and determine when excessive moisture accumulation is likely to occur.

(3) *Attics and Ceilings.* (i) Identify and measure ventilation area in attics. Do not install insulation in attics unless ventilation openings in attic areas conform to one of the following requirements or arrangements have been made to conform to these requirements within six months from the date of installation:

(A) 1 $ft^2$ minimum of free ventilation area per 150 $ft^2$ of attic floor area, if no vapor barrier exists in the attic;

(B) 1 $ft^2$ minimum of free ventilation area per 300 $ft^2$ of attic floor area if a vapor barrier does exist;

(C) 1 $ft^2$ minimum of free ventilation area per 300 $ft^2$ of attic floor space if at least 50 percent of the required ventilating area is provided with fixed ventilation located in the upper portion of the space to be ventilated (at least three feet above eave or soffit vents) with the remainder of the required ventilation provided by eave or soffit vents.

NOTE 4.—Screen or louvers which cover ventilation openings reduce the free ventilation area. Most metal louvers have the free ventilation area stamped on their frame. If the free ventilation area of louvers is not known, assume that it is half of the area of the ventilation opening and increase the opening accordingly.

(ii) Ensure that all ventilation openings have suitable louvers or screens to prevent rain or snow from entering the attic.

(iii) For buildings located in Zones I and II of figure 1, if there is no existing insulation or if existing insulation is to be removed, provide a vapor barrier membrane on the upper surface of the ceiling material. Never install a vapor barrier on top of existing insulation.

NOTE 5.—For buildings in Zones I and II of Figure 1, where there is existing ceiling insulation and no vapor barrier, it is *recommended* that a vapor barrier such as paints and wall coverings which are labeled by the manufacturer as having a perm rating of one (1) or less and are applied in strict accordance to the manufacturer's instructions be installed in the interior surface of bathrooms and unvented kitchens and laundry areas. It is also *recommended* that all cracks and penetrations on the interior ceiling surface of these rooms (such as around lighting fixtures and at wall and ceiling joints) be caulked.

NOTE 6.—The above requirements for moisture control are minimum requirements needed to prevent long term moisture damage. Homes which are characterized by one or more of the following are more likely to experience excessive moisture accumulation which can be corrected by application of a vapor barrier and caulking as described above on the ceilings of all rooms or by additional ventilation of the occupied space.

a. Homes with an area of less than 800 square feet,

b. Homes with less than 250 square feet per occupant,

c. Homes with tight wall and ceiling construction and weatherstripped windows and doors,

d. Electrically heated homes or homes with a heating system which uses outside combustion air.

A relative humidity indicator may be installed to monitor the humidity level and determine when excessive moisture accumulation is likely to occur.

(iv) If a vapor barrier membrane is installed tape all tears, penetrations, and all joints which are not overlapped by at least three (3) inches.

(v) Install blocking around attic doors and bathroom, kitchen or similar vents which open into the attic, if the level to which the insulation will be installed exceeds their height.

NOTE 7.—Ensure that blocking is installed around vent openings in a manner that enables the free movement of air through the vent into the attic.

(vi) Install blocking to restrain loose-fill insulation from clogging soffit vents at the eaves restricting attic ventilation. Install blocking to ensure free movement of air through soffit vents into the attic.

(vii) Cover all bathroom and kitchen vents which open into the attic with temporary blockings prior to the installation of insulation to assure that no insulation material falls into the vents.

(e) *Installation Procedures.* (1) Do not install insulation unless the pre-installation inspection and preparation has been carried out and any defects which were identified, as well as their causes, have been eliminated.

(2) Handle all insulation material in accordance with manufacturer's instructions and keep it dry and free of extraneous materials.

(3) Install insulation so that it will not be in contact with the ground or other sources of water.

(4) Install insulation only between conditioned and unconditioned spaces.

(5) Install insulation in ceilings or floors in such a manner that the electrical wires' temperature under prolonged normal rated loading conditions does not exceed the values specified in the National Electrical Code (Table 310-16 through 19, latest edition) for that particular type of wiring (See Appendix B): *Provided*, the circuit has proper overcurrent protection.

(6) The requirement of paragraph (e)(5) of this section is deemed to be met if exposed wiring in attics is treated as indicated in subparagraphs (6)(i), (ii), or (iii) of this paragraph.

(i) Place insulation in attics up to the underside of electrical wiring. Do not cover electrical wiring; *or*,

(ii) Place permanent barriers which exceed the height of the insulation around the sides of wires and below such wires. The barrier should form a three inch wide air space which will permanently restrain the thermal insulation from covering the electrical conductor(s). The barrier material must be consistent with local code requirements for durability, safety, fire, moisture resistance, and rodent and fungus protection. See Figure 2.

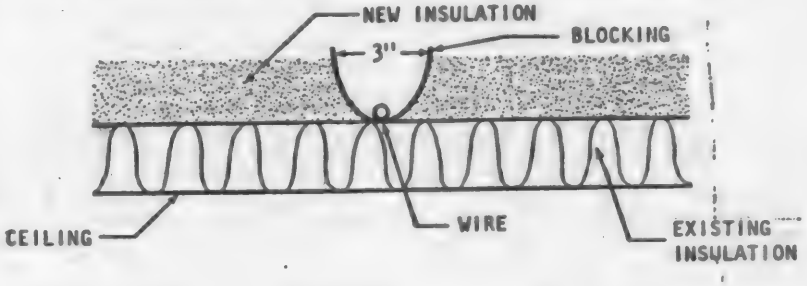


Figure 2. Installing Insulation Around Wires

NOTE 8.—Do not handle electrical wiring with exposed metal conductors or brittle electrical insulation.

(iii) The requirements of paragraphs (6)(i) and (6)(ii) do not apply to single wires which are attached parallel along the joist, provided that the circuit has properly rated overcurrent protection.

(7) Do not fill wall cavities that act as air ducts.

(8) Fill all other wall cavities completely in accordance with the manufacturer's recommendations.

(9) Locate entry holes for pneumatic equipment to permit the complete filling of wall cavities. Open entry holes with a technique that permits refinishing with little or no change in the appearance or structural integrity of the wall.

NOTE 9.—A complete fill generally requires a minimum of two openings per floor per stud space (refer to the manufacturer's instructions). Some construction types may not require the drilling of entry holes to gain access to every cavity. It may be possible to gain access through eave or overhang panels. In addition, in balloon construction access may be gained from the attic.

(10) After the entry holes have been opened, use them to check the wall cavity for fire stops and other obstructions which require additional entry holes to assure complete filling of the cavity.

(11) For pneumatic installation in ceiling areas, use the least air pressure meeting the equipment manufacturer's instructions.

(12) Do not blow insulation into electrical devices or vents which open into the attic.

(13) Fit the attic side of access doors or panels with insulation batt (or equivalent material) except where prevented by a retractable ladder.

(14) Close all entry holes in a workmanlike manner using materials compatible with the original materials. Do not close entry holes in sheathing which is covered by an exterior brick veneer or siding.

(f) *Post-installation Inspection and Procedures.* (1) Inspect the coverage and depth of the insulation. Fill all "pockets" and voids in the insulation. Level insulation in a manner which will not damage wiring or any other items.

(2) Ensure that insulation does not restrict the soffit vents affecting the minimum attic ventilation requirements specified in paragraph (d)(3)(i) of this section.

(3) Ensure that insulation material is not in the air spaces specified in paragraph (d)(1)(ii) of this section.

(4) Clear all electric wall outlets and switches of any insulation material. Turn off electric power while performing these tasks.

(5) Ensure that all cavities that act as air ducts for heating, cooling, or ventilation requirements are not restricted by insulation materials or temporary blocking.

(6) Remove all temporary blockings which were installed under paragraph (d)(3)(vii) of this section.

(7) Ensure that the requirements of paragraphs (e)(5) and (e)(6) of this section have been met.

**§ 456.905 Standard Practice for the Installation of Mineral Fiber Batts and Blankets Thermal Insulation.**

(a) *Scope.* (1) This practice covers the installation of mineral (rock, slag, or glass) fiber batt and blanket thermal insulation in ceilings, attics, floors, walls, and on ducts.

(2) This practice covers the installation process from pre-installation inspection through post-installation inspection. It does not cover the production of the insulation materials.

(3) This practice is not intended to replace the manufacturer's installation instructions unless they are inconsistent with this practice.

(4) This practice is not intended to supersede the authority of state and local codes and regulations unless the requirements of such codes and regulations are less stringent than those prescribed herein.

(5) This practice requires that the person installing the insulation have a working knowledge of the applicable codes and regulations, tools, equipment, and methods necessary for the installation of thermal insulation materials or, in the alternative, that the person supervising the installer have such knowledge. It also requires an understanding of the fundamentals of residential construction that affect the installation of insulation.

(6) This practice covers aspects of installation relating to the effectiveness, durability, and safety of insulation in service.

(7) This practice provides minimum requirements that will help to ensure the installation of insulation in a safe and effective manner. Actual conditions in existing buildings vary greatly and in some cases substantial additional care and precaution may have to be taken to ensure effective and safe installation.

(b) *Significance.* (1) This practice recognizes that effectiveness, safety, and durability of insulation depend not only on the quality of the insulating materials, but also on their proper and workmanlike installation.

(2) Improper installation of insulation may reduce its thermal effectiveness, cause fire hazards and other unsafe conditions, and promote the deterioration of the structure in which it is installed.

NOTE 1.—Specific hazards that can result from improper installation include:

a. deterioration or failure of electrical wiring components and heat buildup caused by overfused electrical circuits or by exposed metal wire conductors when wiring is encapsulated in thermal insulation;

b. fire caused by heat buildup from recessed lighting fixtures covered by insulation;

c. flame spread on exposed flammable vapor barriers; and

d. deterioration of wood structures, paint failures, and corrosion of metal fasteners and electrical components caused by prolonged moisture accumulation within building components.

(c) *Safety Precautions.* Do not smoke or carry an open flame in the attic or where insulation is being installed.

(d) *Pre-Installation Inspection and Preparation*—(1) *General.* (i) Identify all recessed lighting fixtures (including wiring compartments and ballasts), motors, fans, blowers, heaters, furnaces, flues, chimneys, and other heat-producing devices in all areas where insulation is to be installed.

(ii) Inspect the siding, roof, walls, ceilings, and attic floors to identify areas where a previous moisture problem has caused paint peeling, warpage, stain, fungus growth, rotting, or other structural damage. Do not install insulation in such areas unless these conditions and their source(s) have been corrected.

(2) *Attics and Ceilings.* (ii) Identify and measure ventilation area in attics. Do not install insulation in attics unless ventilation openings in attic areas conform to one of the following requirements or arrangements have been made to conform to these requirements within six months from the date of installation:

(A) 1 $ft^2$ minimum of free ventilation area per 150 $ft^2$ of attic floor area, if no vapor barrier exists in the attic;

(B) 1 $ft^2$ minimum of free ventilation area per 300 $ft^2$ of attic floor area if a vapor barrier does exist;

(C) 1 $ft^2$ minimum of free ventilation area per 300 $ft^2$ of attic floor space if at least 50 percent of the required ventilating area is provided with fixed ventilation located in the upper portion of the space to be ventilated (at least three feet above eave or soffit vents) with the remainder of the required ventilation provided by eave or soffit vents.

NOTE 2.—Screens or louvers which cover ventilation openings reduce the free ventilation area. Most metal louvers have the free ventilation area stamped on their frame. If the free ventilation area of louvers is not known, assume that it is half of the area of the ventilation opening and increase the opening accordingly.

(ii) Ensure that all ventilation openings have suitable louvers or screens to prevent rain or snow from entering the attic.

(iii) For buildings located in Zones I and II of Figure 1, if there is no existing insulation or if existing insulation is to be removed, provide a vapor barrier membrane on the upper surface of the ceiling material. Never install a vapor barrier on top of existing insulation.

Figure 1. Condensation Zones in the United States

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NOTE 3. For buildings in Zones I and II of Figure 1, where there is existing ceiling insulation and no vapor barrier, it is recommended that a vapor barrier such as paints and wall coverings which are labeled by the manufacturer as having a perm rating of one (1) or less and are applied in strict accordance to the manufacturer's instructions be installed in the interior surface of bathrooms and unvented kitchens and laundry areas. It is also recommended that all cracks and penetrations on the interior ceiling surface of these rooms (such as around lighting fixtures and at wall and ceiling joints) be chaulked.

NOTE 4. The above requirements for moisture control are minimum requirements needed to prevent long term moisture damage. Homes which are characterized by one or more of the following are more likely to experience excessive moisture accumulation which can be corrected by application of a vapor barrier and caulking as described above on the ceilings of all rooms or by additional ventilation of the occupied space.

a. Homes with an area of less than 800 square feet,

b. Homes with less than 250 square feet per occupant,

c. Homes with tight wall and ceiling construction and weatherstripped windows and doors,

d. Electrically heated homes or homes with a heating system which uses outside combustion air.

A relative humidity indicator may be installed to monitor the humidity level and detemine when excessive moisture accumulation is likely to occur.

(iv) If a separate vapor barrier membrane is installed, tape all tears, penetrations, and all joints which are not overlapped by at least three (3) inches.

(3) *Floors.*

NOTE 5. Insulation of floors over unheated spaces will cause these spaces to be colder. Accordingly, appropriate measures may need to be taken to keep water pipes from freezing during colder weather.

(i) Where insulation is to be installed beneath floors over crawl spaces, cover the ground surface with a ground cover which acts as a vapor barrier (such as 6-mil polyethylene sheeting lapped at the joints and securely taped with duct tape to the interior surface of crawl space foundation walls).

(ii) Where practical in crawl spaces provide a free ventilation area of one square foot for every 1500 square feet of the ground area of the crawl space. Provide cross ventilation where possible. See Note 2 for guidance on estimating free ventilation area.

(iii) Provide a vapor barrier on the winter warm side of floors to be insulated in buildings located in Zones I and II of Figure 1.

(4) *Ducts.* Inspect duct to assure that it is dry and clean and that all joints are tightly sealed. Seal all joints that do not appear tight with tape or other materials.

(e) *Installation procedures.*—(1) *General.* (i) Do not install insulation unless the pre-installation inspection and preparation has been carried out and any defects which were identified, as well as their causes, have been eliminated.

(ii) Handle all insulation material in accordance with manufacturer's instructions and keep it dry and free of extraneous materials.

(iii) Install insulation so that it will not be in contact with the ground or other sources of water.

(iv) Install insulation only between conditioned and unconditioned spaces.

(v) Install insulation so that it fits tightly between framing members on all sides. Cut insulation that is too long for a space to the correct size. If insulation is too short for a space, cut a piece to fill the void. Do not double over or unnecessarily compress insulation.

(vi) Maintain a three inch minimum airspace around motors, fans, blowers, heaters, furnaces and other heat producing devices. If kraft face insulation is used also maintain a three inch minimum airspace between the facing and flues and chimneys. Maintain a three inch minimum airspace around recessed lighting fixtures (including wiring compartments and ballasts). Do not install insulation over recessed lighting fixture enclosures, or their wiring compartments and ballasts, so as to entrap heat and prevent the free circulation of air unless the fixtures are otherwise approved for the purpose.

(vii) Assure that all devices which may require periodic servicing remain accessible after the insulation is installed.

(2) *Walls.* (i) Size insulation correctly to fit tightly at the sides and both ends of the stud space. Tightly butt-joint batts which are shorter than the stud space length.

(ii) Install a vapor barrier on the winter warm side of exterior walls to be insulated in Zones I and II of Figure 1. Secure the vapor barrier to the studs to avoid gaps and fishmouths.

(iii) If the insulation does not have a vapor barrier attached to it, provide a separate vapor barrier on the winter warm side over the installed insulation.

(iv) Tape all tears and penetrations in the vapor barrier and all joints which are not overlapped by at least three inches with duct tape (or equivalent).

(v) If the insulation material is provided with a flammable vapor barrier, or if a separate vapor barrier which is flammable is installed as required under Subdivision (iii) of this paragraph, cover the insulation with a finish material having a finish rating or not less than 15 minutes when tested according to ASTM Designation E119-76.

(3) *Attics, Ceilings, and Floors.* (i) Place vapor barriers as required in paragraphs (d)(2)(iii) and (d)(3)(iii) of this Section on the winter warm side.

(ii) When installing insulation around bridging or cross bracing of ceiling or floor joists, fit the insulation material tightly around these obstructions and assure that there are no gaps in the insulation.

(iii) When recessing insulation batts in floor joist cavities, turn insulation up at the header or cut and attach pieces of insulation to the header to avoid heat loss through the header.

(iv) Fit insulation tightly in floor joist areas and secure in place with either wire fasteners, galvanized wire, or nylon mesh or galvanized screen held in place by stapling or nailing, or galvanized wire lacing held in place by stapling or nailing.

(v) Install insulation in ceilings or floors in such a manner that the electrical wires' temperature under prolonged normal rated loading conditions does not exceed the values specified in the national electrical Code (Table 310-16 through 19, latest edition) for that particular type of wiring (See Appendix B): *Provided,* The circuit has proper overcurrent protection.

(vi) the requirement of Subdivision (v) of this subparagraph is deemed to be met if exposed wiring in attics is treated as indicated below.

(A) Place insulation in attics to the underside of electrical wiring. Do not cover electrical wiring; *or*

(B) If insulation is installed above the level of the wire maintain a minimum air space of three (3) inches around the sides of wires. Do not cover electrical wiring. See Figure 2.

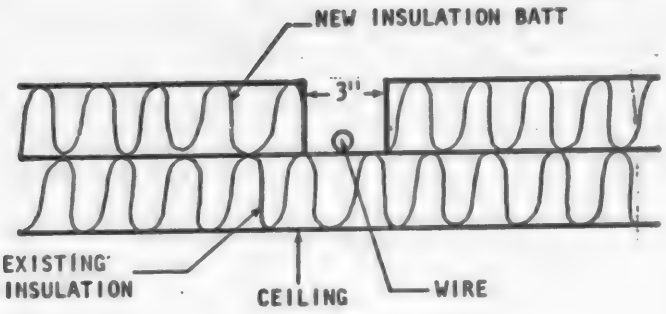


Figure 2. Installing Insulation Around Wires

NOTE 6: Do not handle electrical wiring with exposed metal conductors or brittle electrical insulation.

(c) The requirements of (A) and (B) do not apply to single wires which are attached parallel along the joist provided that the circuit has properly rated overcurrent protection.

(vii) Do not cover soffit vents with insulation nor in any other way restrict attic ventilation.

(viii) Install insulation around vents which open into the attic in a manner that will ensure free movement of air through the vent into the attic.

(ix) Fit the attic side of access doors or panels with insulation batt except where prevented by a retractable ladder.

(4) *Ducts.* (i) Install insulation batt or blanket to the exterior of the duct, with a vapor barrier on the outside.

(ii) Butt joint of batt tightly and in such a way that a vapor barrier tab overlaps the joints by at least two inches. Mechanically fasten the tab to the underlaying vapor barrier and seal the joint with a duct tape.

(iii) On rectangular ducts install insulation so that it is not compressed to more than 50 percent of its nominal thickness at corners.

(iv) On horizontal ducts over 24 inches wide, secure the bottom of the insulation with mechanical fasteners as required by the manufacturer. Seal fastener penetrations to provide air-tight system.

(v) Where ducts are subject to mechanical abuse, such as in all habitable spaces or spaces used for storage, except on ceilings, install a protective cover, if required by local codes and regulations, to provide impact resistance.

*Post-Installation Inspection and Preparation.* (1) Ensure that there are no gaps or areas where insulation is unnecessarily compressed.

(2) Ensure that insulation does not restrict the soffit vents affecting the minimum ventilation requirements specified in paragraph (d)(2)(i) of this section.

(3) Ensure that there is no insulation material in the air spaces specified in paragraph (e)(1)(vi) of this section.

(4) Ensure that all insulation is covered with a suitable covering material in accordance with paragraph (e)(2)(vi) and (e)(4)(vi) of this section.

(5) Ensure that the requirements of paragraphs (e)(3)(v) and (e)(3)(vi) of this section have been met.

**§ 456.906 Standard Practice For the Installation of Organic Cellular Rigid Board Thermal Insulation.**

(a) *Scope.* (1) This practice covers the installation of organic cellular rigid board thermal insulation for concrete floors, foundation perimeter, interior of masonry walls, interior of frame walls, ceilings, and as exterior sheathing on walls and roofs.

(2) This practice covers the installation process from pre-installation inspection through post installation inspection. It does not cover the production of the insulation material.

(3) This practice is not intended to replace the manufacturer's installation instructions unless they are inconsistent with this practice.

(4) This practice is not intended to supersede the authority of state and local codes and regulations unless the requirements of such codes and regulations are less stringent than those prescribed herein.

(5) This practice requires a working knowledge of the applicable codes and regulations, tools, equipment, and methods necessary for the installation of thermal insulation materials. It also requires an understanding of the fundamentals of residential construction that affect the installation of insulation.

(6) This practice provides minimum requirements that will help to ensure the installation of insulation in a safe and effective manner. Actual conditions in existing buildings vary greatly and in some cases substantial additional care and precaution may have to be taken to ensure effective and safe installation.

(7) This practice covers the installation of the rigid board but does not include in detail the installation of exterior siding and roofing required to protect rigid board insulation from the effects of weather or the installation of interior fire protective coverings.

(8) This practice covers aspects of installation relating to the effectiveness, durability, and safty of insulation in service.

(b) *Significance.* (1) This practice recognizes that effectiveness, safety, and durability of insulation depend not only on the quality of the insulation materials, but also on their proper and workmanlike installation.

(2) Improper installation of rigid board insulation may reduce its thermal effectiveness, cause fire hazards and other unsafe conditions, and promote the deterioration of the structure in which it is installed.

(c) *Safety Precautions.* (1) Do not smoke or carry an open flame in any area in which insulation is being installed or cut.

(2) The vapors of many solvents used as mastic and adhesives in the installation of organic cellular rigid board thermal insulation are flammable. Keep solvents in approved containers and carefully follow the specific instructions on the labels.

(d) *General Requirements.* (1) For all rigid board applications, carry out the pre-installation and preparation, installation, and post-installation inspection in the order prescribed in paragraphs (e) through (n) of this section.

(2) For interior applications of rigid board insulation on walls and ceilings, this practice requires, on all exposed faces and edges of the insulation material, a cover having a finish rating of not less than 15 minutes, when tested according to ASTM Designation E 119-76.

NOTE 1.—½-inch gypsum plaster and some ½-inch gypsum board (dry wall) applied in accordance with the manufacturers' instructions provide the required finish rating.

(3) Install insulation only between conditioned and unconditioned spaces except as provided in paragraphs (e) and (h) of this section.

(4) The following provisions apply to the control of moisture in buildings to be insulated:

(i) These provisions apply to all installations of organic cellular rigid insulating boards which do not have an integral vapor barrier on the winter-warm side or do not have a material

structure (such as closed-cell foam) which makes the board, in the thickness commonly used, into a vapor barrier.

(ii) These provisions also apply to installations of all organic cellular rigid board insulation (including those specifically excluded in Subparagraph (i)) where the board is installed on the exterior of a wall which has insulation in a wall cavity on the winter-warm side of the board insulation.

(iii) In all installations to which this section applies and in which insulation is installed on the interior (winter-warm side) of the wall or ceiling in Zones I and II of Figure 1, install a vapor barrier on the winter-warm side, consisting of a continuous sheet meeting the requirements of § 456.902(b)(29), covering the entire solid wall area and placed over the insulation board prior to installing the protective cover required under paragraph (g)(3)(V) of this section. Overlap all joints in vapor barrier membranes by at least three inches or tape the joints. Seal all penetrations of the vapor barrier at electrical outlets, plumbing penetrations, and other obstructions.

Figure 1. Condensation Zones in the United States

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(iv) In installations to which this section applies, but insulation board is installed on the exterior (winter cold side) of the wall or roof in Zones I and II of Figure 1, provide a vapor barrier in the form of a paint or wall covering meeting the requirements of § 456.902(b)(29) in bathrooms and other areas which generate excessive water vapor, such as unvented kitchens and laundry rooms. Seal major cracks on the interior of all insulated areas, including cracks at the floor to wall joints (unless impractical because of carpeting), at joints around window frames, and around wall penetrations for electrical services (outlets, switches, ceiling fixtures), plumbing stacks, and heating and air-conditioning ducts.

NOTE 2.—The above requirements for moisture control are minimum requirements needed to prevent long term moisture damage. Homes which are characterized by one or more of the following are more likely to experience excessive moisture accumulation which can be corrected by application of a vapor barrier and caulking as described above and/or additional venting of the wall cavity from the exterior as additional ventilation of the occupied space.

a. Homes with an area of less than 800 square feet,

b. Homes with less than 250 square feet per occupant,

c. Homes with tight wall and ceiling construction and weatherstripped windows and doors,

d. Electrically heated homes or homes with a heating system which uses outside combustion air.

A relative humidity indicator may be installed to monitor the humidity level and determine when excessive moisture accumulation is likely to occur.

(5) Ensure that only mastics and solvents compatible with the board insulation material are used.

(e) *Foundation Perimeter*—(1) *Applicability.* This section applies to the installation of organic cellular rigid board thermal insulation to the exterior of foundation walls and around the perimeter of concrete slab floors on grade. Only rigid board material that, in the thickness used, constitutes a vapor barrier (as defined in § 456.902(b)(29)) by virtue of its structure shall be used in this application.

(2) *Pre-Installation Inspection and Preparation.* (i) Identify any termite shields that would be covered by the insulation. Do not install board insulation unless the termite shield is effectively extended beyond the insulation and cover to be installed.

(ii) Prepare a trench of not less than 12 inches in depth on the exterior of the foundation.

Note 3. The depth below grade to which the insulation is effective depends on local climate conditions. It is recommended that the insulation be installed to the depth of the frost line or to the bottom of the foundation wall, whichever is less.

(iii) Clean the area to which the insulation is to be applied from all grease, loose paint or material. Ensure that all surfaces are dry.

(iv) Install any anchoring devices required for the application of the covering material.

(v) Identify conditions needing special attention, such as electrical outlets, utility meters, piping, and faucets.

(3) *Installation Procedure.* (i) Do not install insulation board out of doors when the wall surface is wet or the termperature is below freezing.

(ii) Cut board insulation to fit around any surface projections, around windows, and at corners so as to fit tightly against each other and against the anchoring devices.

(iii) Adhere the insulation board against the wall or slab edge assuring an intimate and continuous bond.

(iv) Install a protective cover over the insulation board to provide impact resistance. Fit the cover tightly so as to prevent water and insect penetration.

Note 4. Various protective covers include, but are not limited to, wire and other reenforced cement plaster and heavy-bodied latex coatings. Consult the insulation board manufacturer for compatible coatings.

(v) Back-fill and tamp ground around foundation or slab edge to slope away from the building.

(4) *Post-Installation Inspection.* (i) If termite shields were identified in subparagraph (2)(i) of this paragraph ensure that the shields are extended effectively beyond the covers. Give specific attention to corners and door sills to assure that no paths for insect passage exist.

(ii) Ensure that all joints in the cover are tight and that no cracks exist in cement plaster covers.

(iii) Ensure that all special conditions identified in subparagraph (2)(v) of this paragraph are properly treated and that the installation does not interfere with the proper operation of the devices.

(iv) Ensure that all trenches that were dug are backfilled and tamped, and that they slope away from the wall or slab edge.

(f) *Concrete Floors*—(1) *Applicability.* This section applies to the installation of organic cellular rigid board thermal insulation on concrete floors over unheated basements and crawl spaces or on concrete slabs on grade.

(2) *Pre-Installation Inspection and Preparation.* (i) Ensure that the concrete floor surface is clean, dry, and free of oil and loose paint.

(ii) Fill any cracks in concrete floor with patching cement several days prior to installation.

(iii) Seal joint between floor and walls to reduce air infiltration.

(iv) Identify all floor drains. Do not cover such drains unless permitted by local codes.

(v) When installing insulation on a slab on grade, provide a waterproof barrier such as two separate brushed-on coatings of asphalt emulsion prior to the installation of the rigid board. Consult the board manufacturer for recommendations on coverage.

(3) *Installation Procedure.* (i) Cut the insulation board to appropriate size to provide tight but not forcefit joints.

(ii) Adhere the board thermal insulation to the concrete, assuring an intimate and continuous bond.

(iii) Mechanically fasten the underfloor, either directly or indirectly, to the concrete floor slab.

NOTE 5. Rigid board insulation may be attached to 1 inch by 2 inch or 1 inch by 3 inch (nominal dimensions) furring strips 16 inch on centers. Lay wood furring strips at right angle over the long dimension of the insulation board and fasten with concrete nails to the concrete floor or slab. Furring strips should be placed so that the joints of the underfloor (¼ inch exterior grade plywood) fall on the centers of the furring strips. The underfloor should be adhered to the furring strips, nailed at 4 inches on centers, and sanded smooth.

NOTE 6. The installation of the board insulation on top of concrete floors raises the finish floor 2 inches or more. This may require the adjustment of doors.

(iv) Under any permanently installed heat producing appliance, such as a stove, gas or oil fired water heater, furnace, or boiler, install a non-combustible cover over the underflooring.

(4) *Post-Installation Inspection.* (i) Ensure that the overlayment subfloor is flat, all subfloor butt or tongue and grove joints are tight, and that the subfloor is securely fastened.

(ii) Ensure that a non-combustible cover has been installed as required in subparagraph (3)(iv) of this paragraph.

(g) *Masonry Wall Interior*—(1) *Applicability.* This section applies to the installation of organic cellular rigid board insulation to the interior of masonry walls, particularly basement walls, which separate conditioned and unconditioned spaces.

(2) *Pre-Installation Inspection and Preparation.* (i) Inspect the walls to assure that they are structurally sound, that they are dry and do not show signs of recent dampness such as mold, and that they are clean and free of grease, loose paint, and loose material.

(ii) Remove baseboards or moldings on walls to be insulated.

(iii) Install anchoring devices required for the application of the covering material.

(iv) Determine edge treatment to be provided at windows and doors after installation of insulation and covering.

(v) Identify all electrical outlets and switches or have them extended to the level of the new surface by an approved electrician.

(vi) Identify and seal cracks such as at ceilings, floors, windows, and door frames to reduce air infiltration.

(3) *Installation Procedures.* (i) Do not install insulation board within three inches of open flame heaters, flues, or recessed lighting fixtures.

(ii) Cut the board insulation to fit around any surface projections such as windows, electrical outlets, conduits, and surface mounted water and drain pipes.

(iii) Adhere the insulation board to the wall, assuring an intimate and continuous bond.

(iv) Do not cover water or drain pipes with insulation board (during cold weather, heat from the house may be necessary to prevent the pipes from freezing). If possible, wedge some insulating board pieces between the pipes and the wall.

(v) After all insulation board is applied, install a cover having a finish rating of not less than 15 minutes when tested according to ASTM Designation E 119-76, except as noted in paragraph (d)(2) of this section. Water and drain pipes may be covered with approved covering material.

(vi) Cover the edges of the insulation around electrical outlets and switches, leaving sufficient space to permit their convenient use.

(vii) Replace moldings at floors where necessary, close any gaps and joints at ceilings and corners (tape and spackle for gypsum drywall), and install trim as needed around doors and windows.

(4) *Post-Installation Inspection.* (i) Ensure that all surfaces of insulation are covered in accordance with the requirements of paragraph (d)(2) of this section.

(ii) Ensure that electrical outlets and switches operate freely.

(iii) Ensure that the requirements of subparagraph (3)(i) of this paragraph regarding the installation of insulation board within three inches of heat producing equipment have been met.

(h) *Masonry Crawl Space Walls*—(1) *Applicability.* As an alternate to insulating the floor over a crawl space, the walls of the crawl space may be insulated even though this is not a conditioned space.

(2) *Pre-Installation Inspection, Preparation, Installation, and Post-Installation Inspection.* (A) All applicable provisions of paragraph (g) of this section shall apply.

(B) Do not cover ventilation openings, but provide a means for closing the openings during the winter.

(C) Install a ground cover which meets the vapor barrier criteria as defined in § 456.902(b)(29).

(i) *Frame Wall Interior*—(1) *Applicability.* This section applies to the installation of organic cellular rigid board insulation to the interior of finished framed wall constructions which separate conditioned from unconditioned spaces.

(2) *Pre-Installation Inspection and Preparation.* (i) Apply all provisions of paragragh (g)(2) of this section.

(ii) Secure the anchoring devices specified in paragraph (g)(2)(iii) of this section to the wall framing studs.

(iii) Identify water and drain pipes both on the surface of the wall and in the wall cavities. Provide nailers as needed for attaching the covers required in paragraph (d)(2) of this section.

(3) *Installation Procedures.* (i) Install insulation board according to the procedures given in paragraph (g)(3) of this section.

(ii) Do not install insulation over stud spaces that contain water supply or waste pipes (during cold weather, heat from the house may be necessary to prevent the pipes from freezing). The covering material may be placed over stud spaces containing pipes.

(4) *Post-Installation Inspection.* Conduct post-installation inspection as

required in paragraph (g)(4) of this section.

(j) *Ceilings*—(1) *Applicability.* This section applies to the installation of organic cellular rigid board insulation to the underside (winter warm side) of existing plaster or gypsum board ceilings. See paragraph (k) of this section for requirements for the interior installation of insulation board to wood roof decks.

(2) *Pre-Installation Inspection and Preparation.* (i) Inspect the ceilings to assure that they are structurally sound, that they are dry and do not show signs of recent dampness such as mold, are clean, free of grease, loose paint, and loose material.

(ii) Remove any existing moldings at the wall to ceiling joint or on the ceiling itself.

(iii) Identify electrical outlets and recessed lighting fixtures or have an approved electrician lower these to the level of the new finished ceiling surface.

(iv) Identify the location of ceiling joists.

(v) Seal all cracks at wall to ceiling joints, and any other cracks such as at electrical outlets.

(3) *Installation Procedure.* (i) Maintain a three inch airspace around recessed lighting fixtures, flues, and other heat producing devices.

(ii) Cut insulation board to appropriate size.

(iii) Adhere the board to the ceiling assuring an intimate and continuous bond.

(iv) Install a cover having a finish rating of not less than 15 minutes when tested according to ASTM Designation E 119-76, except as noted in paragraph (k)(2) of this section.

(v) If the cover consists of gypsum or similar board material, install the board so that the joints fall on the center line of the ceiling joists and nail the board to the joists with nails of sufficient length to penetrate the cover material, the insulation board, the existing ceiling, and into the ceiling joist.

(vi) Finish the ceiling with tape and spackle as required.

(4) *Post-Installation Inspection.* (i) Ensure that all surfaces and edges of insulation board are covered with a material having a finish rating of at least 15 minutes when tested according to ASTM Designation E 119-76, except as noted in paragraph (d)(2) of this section.

(B) Ensure that the requirements of subparagraph (3)(i) of this paragraph have been met.

(k) *Exposed Wood Deck Ceilings*—(1) *Applicability.* This section applies to the installation of organic cellular rigid board insulation to the underside (winter warm side) of exposed wood roof decks.

(2) *Pre-Installation Inspection and Preparation.* Apply all applicable provisions of paragraph (j)(2) of this section.

(3) *Installation Procedure.* (i) Cut the insulation board to fit snugly between any exposed joists or rafters.

(ii) Maintain a three inch airspace around lighting fixtures, flues, and other heat producing devices.

(iii) Install the insulation board with mechanical fasteners to the wood deck insuring firm attachment but not puncturing the roofing.

(iv) Install a cover having a finish rating of not less than 15 minutes when tested in accordance with ASTM Designation E 119-76, except as noted in paragraph (d)(2) of this section.

(v) Secure the cover through the insulation board into the wood deck. Insure that the nails do not puncture the roofing.

(vi) Finish the ceiling with tape and spackle as required and install edge trim as needed.

(4) *Post-Installation Inspection.* (i) Ensure that all surfaces and edges of insulation board are covered in accordance with subparagraph (3)(iv) of this paragraph.

(B) Ensure that the requirements of subparagraph (3)(ii) of this paragraph have been met.

(l) *Frame Wall Exterior*—(1) *Applicability.* This section applies to the installation of organic cellular rigid board insulation to the exterior of framed walls.

(2) *Pre-Installation Inspection and Preparation.* (i) Inspect the walls to assure that they are structurally sound, and that they are free of fungus growth (dry rot). If the existing exterior wall cover is sound and free of rot, insulation can be installed over the existing siding. if the existing surface is attacked by fungus growth, remove the old siding. If the old siding is removed, assure that the structural integrity of the walls is maintained, either by the remaining cross bracing or the installation of new siding.

(ii) Remove any trim around windows, doors, corners, and at the sills as required to install the insulation.

(iii) Identify any termite shields that would be covered by the insulation. Do not install board insulation unless the termite shield is effectively extended beyond the insulation and cover to be installed.

(iv) Determine edge treatment to be given at corners, sills, windows, and doors.

(v) Identify conditions needing special attention, such as electrical outlets, utility meters, and faucets.

(3) *Installation Procedure.* (A) If the existing wood siding is sound and left in place (see subparagraph (2)(i) of this paragraph), install the insulation board with mechanical fasteners to the wood siding in accordance with the manufacturer's instructions.

(ii) If the existing siding was removed, or if the siding consists of light gauge metal over an "insulation board" sheathing, install the organic cellular rigid insulation board with mechanical fasteners to the wall studs or to an existing wood sheathing in accordance with the manufacturer's instructions.

(iii) Do not install insulation board in contact with flues, chimneys, or appliances that could reach temperatures above 150° F.

(iv) Cover the insulation board with a suitable weather resisting exterior finish, such as aluminum or vinyl siding, wood or asbestos shingles, or metal lath and stucco.

(v) Attach the cover through the insulation board to an existing wood siding or sheathing to the wood frame studs; or attach furring strips or a plywood nailer through the insulation board to the stud wall and attach the finish to the strips or nailer.

(vi) Install flashing and trim at windows, doors, corners, and sills so as to preclude the penetration of water into the wall cavity.

(vii) Flash and seal around any obstructions such as at water faucets and electrical outlets.

(viii) Provide weep holes at the sill plate as required.

(ix) Where insulation board is installed on walls which have cavity insulation, provide for moisture control in accordance with paragraph (d)(4) of this section.

(4) *Post-Installation Inspection.* (i) Ensure that the installation meets the provisions of subparagraph (3)(iii) of this paragraph.

(ii) Ensure that all surfaces of insulation board are covered with a suitable weather resisting finish material.

(iii) Ensure that joints in trim, flashing, and protective cover at windows, doors, corners, faucets, and electrical outlets are tight and sealed as required.

(iv) Ensure that weep holes are provided as required and are free from clogging material.

(m) *Masonry Wall Exterior.*—(1) *Applicability.* This section applies to the installation of organic cellular rigid board insulation to the exterior of masonry or masonry veneer walls.

(2) *Pre-Installation Inspection and Preparation.* (i) Inspect the walls to assure that they are structurally sound and free of grease, loose paint, or loose material.

(ii) Remove any trim around windows, doors, corners, and at the sill as required to install the insulation.

(iii) Identify any termite shields that would be covered by the insulation. Do not install board insulation unless the termite shield is effectively extended

beyond the insulation and cover to be installed.

(iv) Determine edge treatment to be given at corners, sills, windows, and doors.

(v) Identify conditions needing special attention, such as electrical outlets, utility meters, and faucets.

(3) *Installation Procedure.* (i) Attach the insulation board to the wall as recommended by the manufacturer.

(ii) Do not install the insulation board in contact with flues, chimneys, or appliances that could reach temperatures above 150° F.

(iii) Cover the insulation board with a suitable weather resistant exterior finish, such as aluminum or vinyl siding, wood or asbestos shingles, or metal lath and stucco.

(iv) Fasten the cover through the insulation board onto the masonry wall; or secure furring strips or a plywood nailer base through the insulation board onto the masonry wall and attach the finish to the strips or nailer base.

(v) Install flashing and trim at windows, doors, corners, and sills so as to preclude the penetration of water.

(vi) Flash and seal around any obstructions such as at water faucets and electrical outlets.

(vii) Provide weep holes at the sill plate as required.

(4) *Post-Installation Inspection.* (i) Ensure that the requirements of subparagraph (3)(ii) of this paragraph have been met.

(ii) Ensure that the insulation board has been properly covered as required in subparagraph (3)(iii) of this paragraph.

(iii) Ensure that all required flashing and sealing has been provided.

(iv) Check that all necessary weep holes at the still plate have been provided and are unobstructed.

(n) *Roof Exterior*—(1) *Applicability.* This section applies to the installation of organic cellular rigid board insulation to the exterior of sloped roofs. This section does not apply to roofs over unheated attics.

(2) *Pre-Installation Inspection and Preparation.* (i) Inspect the roof to assure that it is structurally sound. Sagging of the roof sheathing indicates an unsound roof.

(ii) One layer of existing roofing may be left in place or may be removed. If there are two or more layers of roofing, remove all roofing.

(iii) Install nailers the thickness of the insulation board along all edges and along the ridge.

(3) *Installation Procedure.* (i) Install insulation board as recommended by the manufacturer. Use an application method which fastens the insulation to the roof sheathing. Do not use adhesive to fasten the insulation to shingles or roofing felt only.

(ii) Do not install insulation board in contact with flues or chimneys that could reach temperatures above 150° F.

(iii) Depending on thickness, density, and compressive strength of the board, overlay the insulation with roofing felt or install a plywood base to the top of the insulation board, nailing it through the insulation board to the roof sheathing and cover the plywood with roofing felt. A plywood base is also required by some local building codes.

(iv) Finish the exterior with roofing following the manufacturer's instructions. Use nails long enough to penetrate into the plywood overlay or through the insulation board into the existing wood sheathing.

(v) Install all flashing, gutters, and trim as required.

(4) *Post-Installation Inspection.* (i) Ensure that the insulation board was not installed in contact with flues or chimneys that could reach temperatures in excess of 150° F.

(ii) Ensure that the new finished roofing covers the entire insulation roof.

(iii) Ensure that all flashing is properly installed, particularly at dormers, chimney, or where the roof adjoins vertical wall sections.

### § 456.907 Standard Practice for the Installation of Mineral Cellular Loose-Fill Thermal Insulation.

(a) *Scope.* (1) This practice covers the installation of perlite and vermiculite mineral cellular loose-fill thermal insulation.

(2) This practice applies only to the installation of mineral cellular loose-fill thermal insulation in attic floors and various masonry cavities (concrete block, block-brick veneer, and masonry walls wherein the wall cavity opens into the attic) by means of pouring application. It does not apply to installation by pneumatic machinery processes.

(3) This practice covers the installation process from pre-installation inspection through post-installation inspection. It does not cover the production of the insulation materials.

(4) This practice is not intended to replace the manufacturer's installation instructions unless they are inconsistent with this practice. 000

(5) This practice is not intended to supersede the authority of local codes and regulations unless the requirements of such codes and regulations are less stringent than those prescribed herein.

(6) This practice requires that the person installing the insulation have a working knowledge of the applicable codes and regulations, tools, equipment, and methods necessary for the installation of thermal insulating materials or, in the alternative, that the person supervising the installer have such knowledge. It also requires an understanding of the fundamentals of residential construction that affect the installation of insulation.

(7) This practice covers aspects of installation relating to the effectiveness, durability, and safety of insulation in service.

(8) This practice provides minimum requirements that will help to ensure the installation of insulation in a safe and effective manner. It must be noted that actual conditions in existing buildings vary greatly and in some cases substantial additional care and precaution may have to be taken to assure effective and safe installation.

(b) *Significance.* (1) This practice recognizes that effectiveness, safety, and durability of insulation depend not only on the quality of the insulating materials but also on their proper and workmanlike installation.

(2) Improper installation of insulation may reduce its thermal effectiveness, contribute to fire hazards and other unsafe conditions, and promote deterioration of the structure in which it is installed.

NOTE 1.—Specific hazards that can result from improper installation includes:

a. Deterioration or failure of electrical wiring components and heat buildup caused by overfused electrical circuits or by exposed metal wire conductors, when wiring is encapsulated in thermal insulation;

b. Fire caused by heat buildup from recessed lighting fixtures covered by insulation;

c. Flame spread on exposed flammable vapor barriers; and

d. Deterioration of wood structures, paint failures, and corrosion of metal fasteners and electrical components caused by prolonged moisture accumulation within building components.

(c) *Pre-Installation Inspection and Preparation.*—(1) *General.* (i) Identify all recessed lighting fixtures (including wiring compartments and ballasts), motors, fans, blowers, heaters, furnaces, and other heat producing devices in all areas where insulation is to be installed.

(ii) Install blocking, such as wood, metal, unfaced mineral wool batts, or non-flammable rigid cardboard, around items identified in subdivision (i) of this subparagraph to permanently maintain a 3-inch minimum air space all around them. Install blocking at least as high as the height of the finished insulation. Do not cover recessed lighting fixture enclosures, or their wiring compartments and ballasts, so as to entrap heat and prevent the free circulation of air unless the fixture(s) are otherwise approved for the purpose.

(iii) Install necessary blocking so that all devices which may require maintenance or servicing remain ac-

cessible after the insulation is installed.

(iv) Inspect the siding, roof, walls, ceilings, and attic floors to identify areas where a previous moisture problem has caused paint peeling, warpage, stain, fungus growth, rotting, or other structural damage. Do not install insulation in such areas unless these conditions and their source(s) have been corrected.

(v) Block all openings in ceilings, floors, and sidewalls through which the insulating material may escape. Seal all wall cavities which open into a basement or crawl space before wall insulation is installed.

(vi) Determine the structural soundness and strength of walls or ceilings. Do not install insulation in areas too weak to withstand the pressures or loads created by the filling process unless such condition has been corrected.

(2) *Attics and Ceilings.* (i) Identify and measure ventilation area in attics. Do not install insulation in attics unless ventilation openings in attic areas conform to one of the following requirements or arrangements have been made to conform to these requirements within six months from the date of installation:

(A) 1 $ft^2$ minimum of free ventilation area per 150 $ft^2$ of attic floor area, if no vapor barrier exists in the attic;

(B) 1 $ft^2$ minimum of free ventilation area per 300 $ft^2$ of attic floor area if a vapor barrier does exist;

(C) 1 $ft^2$ minimum of free ventilation area per 300 $ft^2$ of attic floor space if at least 50 percent of the required ventilating area is provided with fixed ventilation located in the upper portion of the space to be ventilated (at least three feet above eave or soffit vents) with the remainder of the required ventilation provided by eave or soffit vents.

NOTE 2.—Screens or louvers which cover ventilation openings reduce the free ventilation area. Most metal louvers have the free ventilation area stamped on their frame. If the free ventilation area of louvers is not known, assume that it is half of the area of the ventilation opening and increase the opening accordingly.

(ii) Ensure that all ventilation openings have suitable louvers or screens to prevent rain or snow from entering the attic.

(iii) For buildings located in Zones I and II of Figure 1, if there is no existing insulation or if existing insulation is to be removed, provide a vapor barrier membrane on the upper surface of the ceiling material. Never install a vapor barrier on top of existing insulation.

Figure 1. Condensation Zones in the United States

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NOTE 3.—For buildings in Zones I and II of Figure 1, where there is existing ceiling insulation and no vapor barrier, it is *recommended* that a vapor barrier such as paints and wall coverings which are labeled by the manufacturer as having a perm rating of one (1) or less and are applied in strict accordance to the manufacturer's instructions be installed in the interior surface of bathrooms and unvented kitchens and laundry areas. It is also *recommended* that all cracks and penetrations on the interior ceiling surface of these rooms (such as around lighting fixtures and at wall and ceiling joints) be caulked.

NOTE 4.—The above requirements for moisture control are minimum requirements needed to prevent long term moisture damage. Homes which are characterized by one or more of the following are more likely to experience excessive moisture accumulation which can be corrected by application of a vapor barrier and caulking as described above on the ceiling of all rooms or by additional ventilation of the occupied space.

a. Homes with an area of less than 800 square feet,

b. Homes with less than 250 square feet per occupant,

c. Homes with tight wall and ceiling construction and weatherstripped windows and doors,

d. Electrically heated homes or homes with a heating system which uses outside combustion air.

A relative humidity indicator may be installed to monitor the humidity level and determine when excessive moisture accumulation is likely to occur.

(iv) If a vapor barrier membrane is installed, tape all tears, penetrations, and all joints which are not overlapped by at least three (3) inches.

(v) Install blocking around attic doors and bathroom, kitchen or similar vents which open into the attic, if the level to which the insulation will be installed exceeds their height.

NOTE 5.—Ensure that blocking is installed around vent openings in a manner that enables the free movement of air through the vent into the attic.

(vi) Install blocking to restrain loose-fill insulation from clogging soffit vents at the eaves restricting attic ventilation. Install blocking so as to ensure free movement of air through soffit vents into the attic.

(vii) Cover all bathroom and kitchen vents which open into the attic with temporary blockings prior to the installation of insulation to assure that no insulation material falls into the vents.

(d) *Installation Procedure.* (1) Do not install insulation unless the pre-installation inspection and preparation has been carried out and any defects which were identified, as well as their causes, were eliminated.

(2) Handle all insulation material in accordance with manufacturer's instructions and keep it dry and free of extraneous materials.

(3) Install insulation so that it will not be in contact with the ground or other sources of water.

(4) Install insulation only between conditioned and unconditioned spaces.

(5) When installing insulation above gypsum board ceilings or above existing insulation which is resting on a gypsum board ceiling, do not install an amount of new insulation which would cause the total weight of the existing insulation and new insulation per square foot of ceiling area to exceed the loads specified in Column 3 of Table 1.

TABLE 1.—*Maximum Allowable Loads*

| (1) Gypsum board ceiling thickness | (2) Frame spacing | (3) Total allowable load |
|---|---|---|
| ½" | 24" O.C. | 1.3 psf |
| ½" | 16" O.C. | 2.2 psf |
| ⅝" | 24" O.C. | 2.2 psf |

NOTE 6.—For ceilings other than gypsum board, establish the allowable load by acceptable engineering principles and do not install insulation in excess of the established total allowable load.

(6) Fill all wall cavities completely in accordance with the manufacturer's recommendations.

(7) When installing insulation in the cavity of an enclosed attic floor, remove the floor to facilitate proper installation and coverage.

(8) Install insulation in ceilings or floors in such a manner that the electrical wires' temperature under prolonged normal rated loading conditions does not exceed the values specified in the National Electrical Code (Table 310-16 through 19, latest edition) for that particular type of wiring (see Appendix B): *Provided*, The circuit has proper overcurrent protection.

(9) The requirement of subparagraph (8) of this paragraph is deemed to be met if exposed wiring in attics is treated as indicated in Subdivisions (i), (ii) and (iii) of this subparagraph.

(i) Place insulation in attics to a uniform depth up to the underside of electrical wiring. Do not cover electrical wiring; *or*,

(ii) Place permanent barriers which exceed the height of the insulation around the sides of wires and below such wires. The barrier should form a three inch wide air space which will permanently restrain the thermal insulation from covering the electrical conductor(s). The barrier material must be consistent with local code requirements for durability, safety, fire, moisture resistance, and rodent and fungus protection. See figure 2.

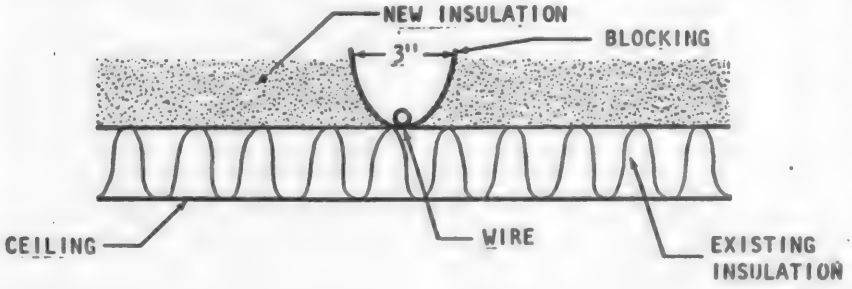


Figure 2. Installing Insulation Around Wires

NOTE 7.—Do not handle electrical wiring with exposed metal conductors or brittle electrical insulation.

(iii) The requirements of divisions (i) and (ii) of this subparagraph do not apply to single wires which are attached parallel along the joist: *Provided*, That the circuit has properly rated overcurrent protection.

(10) Pour the insulating material into the spaces and cavities to be insulated.

NOTE 8.—A minimum amount of impact and working of the material should take place to minimize crushing of the cellular material and the formation of dust. Pouring in masonry wall cavities should be performed slowly to allow material to flow without creating restrictions.

(11) Fit the attic side of access doors or panels with insulation batt (or equivalent material) except where prevented by a retractable ladder.

(12) For buildings located in Zone I of Figure 1, provide a vapor barrier on the interior surface of all bathrooms and unvented kitchens and laundry areas. Caulk or seal all major cracks in the exterior walls of these rooms including joints between the floor and wall (except where impractical because of carpeting), between wall and ceiling, at joints around window frames, and around wall penetrations for electrical services (outlets and switches) and plumbing stacks.

NOTE 9.—It is *recommended* that a vapor barrier and caulking, such as described in this section, also be provided in the buildings in Zone II of Figure 1.

NOTE 10.—The above requirements for moisture control are minimum requirements needed to prevent long term moisture damage. Homes which are characterized by one or more of the following are more likely to experience excessive moisture accumulation which can be corrected by application of a vapor barrier and caulking in all ceiling areas as described above and/or additional venting of the wall cavity from the exterior or by additional ventilation of the occupied space.

a. Homes with an area of less than 800 square feet,

b. Homes with less than 250 square feet per occupant,

c. Homes with tight wall and ceiling construction and weatherstripped windows and doors,

d. Electrically heated homes or homes with a heating system which uses outside combustion air.

A relative humidity indicator may be installed to monitor the humidity level and determine when excessive moisture accumulation is likely to occur.

(e) *Post-Installation Inspection and Procedures.* (1) Inspect the coverage and depth of the insulation. Fill all "pockets" and voids in the insulation. Level insulation in a manner which will not damage wiring or any other items.

(2) Ensure that insulation does not restrict the soffit vents affecting the minimum attic ventilation requirements specified in paragraph (c)(2)(i) of this section.

(3) Ensure that insulation material is not in the air spaces specified in paragraph (c)(1)(iii) of this section.

(4) Clear all electric wall outlets and switch boxes of any insulation material. Turn off electric power while performing these tasks.

(5) Remove all temporary blockings which were installed under paragraph (c)(2)(vii) of this section.

(6) Replace attic flooring material which was removed to facilitate insulating the attic. Floor material shall not compact or disturb the insulating material.

(7) Ensure that the requirements of paragraphs (d)(9) and (d)(10) of this section have been met.

**§ 456.908 Standard practice for the installation of reflective insulation.**

(a) *Scope.* (1) This practice covers the installation of reflective (aluminum foil) insulation under floors of heated spaces that are over unheated crawl spaces and unheated basements.

(2) This practice covers the installation of reflective insulation from preinstallation inspection through postinstallation inspection. It does not cover the production of the insulation material.

(3) This practice is not intended to replace the manufacturer's installation instructions unless they are inconsistent with this practice.

(4) This practice is not intended to supersede the authority of state or local codes and regulations unless the requirements of such codes and regulations are less stringent than those prescribed herein.

(5) This practice requires that the person installing the insulation have a working knowledge of the applicable codes and regulations, tools, equipment, and methods necessary for the installation of reflective insulating materials or, in the alternative, that the person supervising the installer have such knowledge. It also requires an understanding of the fundamentals of residential construction that affect the installation of insulation.

(6) This practice covers aspects of installation relating to the effectiveness, durability, and safety of insulation in service.

(7) This practice provides minumum requirements that will help to ensure the installation of insulation in a safe and effective manner. Actual conditions in existing buildings vary greatly and in some cases substantial additional care and precautions may have to be taken to ensure effective and safe installation.

(b) *Significance.* (1) This practice recognizes that effectiveness, safety, and durability of insulation depend not only on the quality of the insulating materials, but also on their proper and workmanlike installation.

(2) Improper installation of insulation may reduce its thermal effectiveness, cause electrical hazards and other unsafe conditions, and promote deterioration of the structure in which it is installed.

(c) *Pre-Installation Inspection and Preparation.* (1) Identify and examine all visible wiring, junction boxes, and other metallic or electrical equipment in the areas where insulation is to be installed. Do not install reflective insulation if the wiring is found to have frayed, cracked, deteriorated or missing electrical insulation.

(2) Ensure that all electrical equipment in the building is grounded. Do not install reflective (aluminum foil) insulation in a building in which electrical equipment is not grounded.

(3) Identify air supply and return ducts, pipes, electrical wires and other obstructions located in spaces between floor joists over crawl spaces and unheated basements. Ground all metallic heating and air conditioning ducts which may come in contact with the installed insulation. Do not install reflective insulation where metallic heating and air conditioning ducts are not grounded.

NOTE 1.—Repairs or replacement of electrical wiring to eliminate defects identified in Paragraph (1) as well as all other electric-related activities are to be carried out only by personnel approved for such work.

NOTE 2.—Insulation of floors over unheated spaces will cause these spaces to be colder. Accordingly, appropriate measures may need to be taken to keep water pipes from freezing during colder weather.

(4) Measure the width of the spacing between floor joists to determine the correct width of the insulation required to meet the manufacturer's installation instructions.

(5) Measure the length of runs between obstructions and cut the insulation in a manner which will minimize the number of joints.

(6) When installing reflective insulation beneath floors over crawl spaces, cover the ground surface with a ground cover which acts as a vapor barrier (such as 6-mil polyethylene sheeting lapped at the joints and securely taped with duct tape to the interior surface of the crawl space foundation walls).

(7) Where practical in crawl spaces provide a free ventilation area of one square foot for every 1,500 square feet of the ground area before insulation is applied. Provide cross-ventilation where possible.

NOTE 3.—Where screens or louvers cover ventilation openings the free ventilation area is reduced. Most metal louvers have the free area stamped on their frame. If the free ventilation area of the louvers is not known, assume that it is half of the area of the ventilation opening and increase the opening accordingly.

(8) Ensure that reflective surfaces are free of dirt, oil film, and other surface coatings before installation. These coatings can reduce the effective reflectance of the surfaces.

(d) *Installation Procedures.* (1) Do not install reflective insulation unless the pre-installation inspection and preparation has been carried out and any defects which were identified, as well as their causes, have been eliminated.

(2) Mount reflective insulation in a flush (see Figure 1) or recessed (see Figure 2) application depending on the space available.

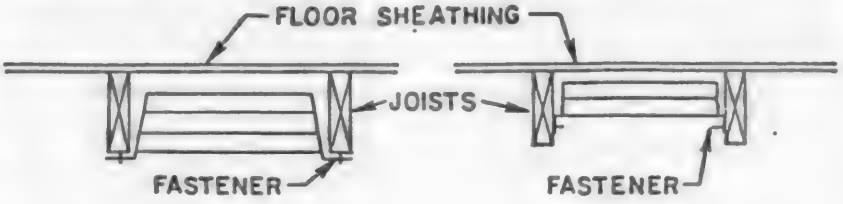


FIG. 1 FIG. 2

(3) Use aluminum, stainless steel, or plastic fasteners of a type and spacing recommended by the insulation manufacturer. Assure that the reflective insulation is in close contact with the joists along both its edges and that there are no wrinkles or fishmouths. Where wrinkles and/or fishmouths do exist, tape the joint between the insulation and joist, or between adjacent sections of insulation in flush mounted installations.

(4) Avoid joints within the length between joist supports or basement walls. Seal joints which are required with tape.

(5) Tightly seal the ends of reflective insulation at floor support and basement walls against the supports and walls with tape.

(6) Seal all punctures in the reflective insulation by taping reflective material to the damaged area.

(7) Closely fit insulation around plumbing and other obstructions and tape securely to eliminate gaps through which air may pass into the reflective air spaces.

(8) Ensure that where the material is installed to form multiple reflective air spaces, the spaces are, at a minimum, ¾ of an inch in height. Maintain the distance between reflective surfaces as uniformly as possible.

NOTE 4.—Reflective surfaces must not touch each other or the thermal performance of the insulation will be reduced.

(e) *Post-Installation Inspection.* (1) Ensure that the reflective insulation provides a continuous and unbroken surface between joists, that no gaps, tears, and other openings exist, and that all joints are tightly taped.

**§ 456.909 Certification Procedures for the Installation of Thermal Insulation Materials.**

(a) Upon completion of each installation of thermal insulation materials performed under the circumstances described in the State Plan pursuant to § 456.305, the person responsible for carrying out such installation shall complete, in triplicate, a "Certification of Insulation" form such as exhibited in Figure 1.

PART I - GENERAL

ADDRESS OF RESIDENCE: NAME AND ADDRESS OF CONTRACTOR:

DATE OF INSTALLATION COMPLETION:

PART II - AREAS INSULATED

| WALLS (____ sq. ft.) | CEILINGS (____ sq. ft.) | FLOORS (____ sq. ft.) |
|---|---|---|
| TYPE OF INSULATION: | TYPE OF INSULATION: | TYPE OF INSULATION: |
| MANUFACTURER: | MANUFACTURER: | MANUFACTURER: |

| R VALUE INSTALLED | AMOUNT INSTALLED | R VALUE INSTALLED | AMOUNT INSTALLED | R VALUE INSTALLED | AMOUNT INSTALLED |
|---|---|---|---|---|---|
| | | | | | |

PART III - CERTIFICATION

I, _____ (PRINT NAME) certify that the residence identified in PART I was insulated as specified in PART II and the installation was conducted in conformance to applicable codes, standards, and regulations.

_____ Authorized Signature

**Figure 1. Certification of Insulation**

(b) *Content.* The "Certification of Insulation" shall contain the following information:

(1) Address of the building;

(2) Date of completion of installation;

(3) Name and address of the contractor;

(4) Insulation type;

(5) Insulation manufacturer;

(6) Location and dimension (in square feet) of each space which was insulated;

(7) The amount of insulation which was installed in each of the locations identified in subparagraph (6) of this paragraph, given in the units in which the material is most commonly available (*i.e.*, the number of batts, bags, etc., of a specified size or the number of square feet, etc.);

(8) The R value installed in each of the locations identified in subparagraph (6) of this paragraph;

(9) A statement, signed by an authorized individual, certifying that the installation was carried out in conformance to the applicable standard practices, codes and regulations.

(c) *Distribution and Posting Requirements.* The "Certification of Installation" shall be distributed and posted as follows:

(1) One copy shall be affixed to the structure in an accessible but inconspicuous location;

(2) One copy shall be submitted to the homeowner or building occupant; and

(3) One copy shall be retained for a period of five years by the person who conducted the installation.

**§ 456.910 Standard Practice for the Installation of Storm Windows, Thermal Windows, Multi-Glazing Units and Storm Doors and Thermal Doors.**

(a) *Scope.* (1) This practice covers the installation of storm windows, thermal windows, multi-glazing units, storm doors and thermal doors.

(2) This practice applies to wood, metal, and plastic framed storm windows or thermal windows, sealed multi-glazing units, non-sealed multi-glazing systems, storm doors and thermal doors. This practice also applied to multi-glazing systems which include heat absorbing or heat reflective glazing.

(3) This practice covers the installation process from pre-installation inspection through post-installation inspection. It does not cover the fabrication or assembly of units whether such fabrication takes place in a factory or at the installation site.

(4) This practice is not intended to replace the manufacturer's installation instructions unless they are inconsistent with this practice.

(5) This practice is not intended to supersede the authority of state and local codes and regulations unless the requirements of such codes and regulations are less stringent than those prescribed herein.

(6) This practice requires that the person installing the insulation have a working knowledge of the applicable codes and regulations, tools, equipment, and methods necessary for the installation of storm windows, thermal windows, and multi-glazing and storm doors or, in the alternative, that the person supervising the installer have such knowledge. It also requires familiarity with caulking and sealing and with glass handling procedures, painting where applicable, and an understanding of the fundamentals of residential construction that affect the installation of these units.

(7) This practice covers aspects of installation relating to the effectiveness, durability, and safety in service.

(8) This practice provides minimum requirements that will help to ensure the installation of storm windows, thermal windows, multi-glazing and storm doors in a safe and effective manner. Actual conditions in existing buildings vary greatly and in some cases substantial additional care and precaution may have to be taken to ensure effective and safe installation.

(b) *Significance.* (1) This practice recognizes that effectiveness, safety, and durability of installed units depend not only on the choice and quality of materials, design, adequacy of assembly and support system, but also on their proper and workmanlike installation.

(2) Improper installation of units may reduce their thermal effectiveness, lead to excessive condensation and promote the deterioration of wall constructions, windows, doors, and their respective finishes. Additionally, improper installation of metal units may result in accelerated corrosion of the metal frames, trim, anchors, fasteners, and finishes. Also, unsafe conditions are created when warping of frames requires excessive force for operation.

(c) *Definitions.* Technical terms used in this practice which are not defined in § 456.902 are illustrated in Figures 1 through 3.

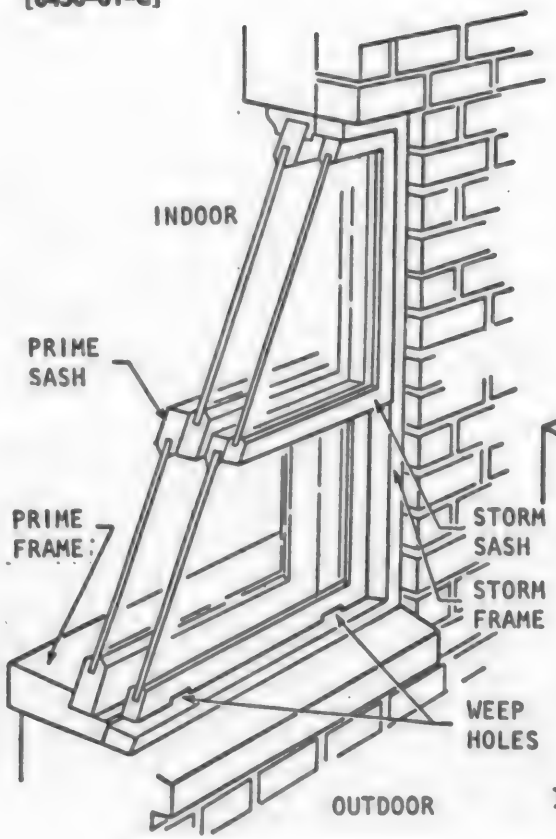


Figure 1. Storm Windows

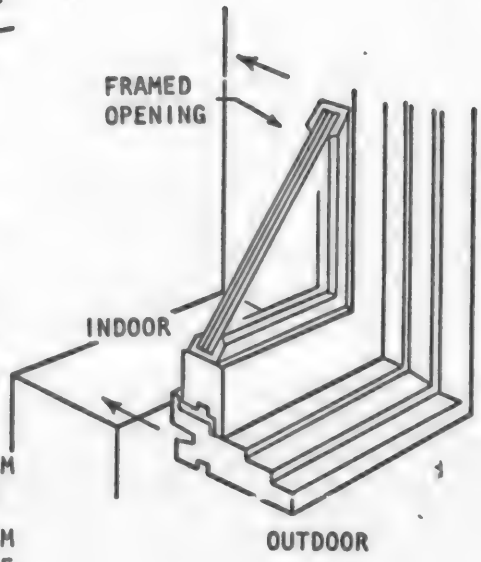


Figure 2. Thermal Windows

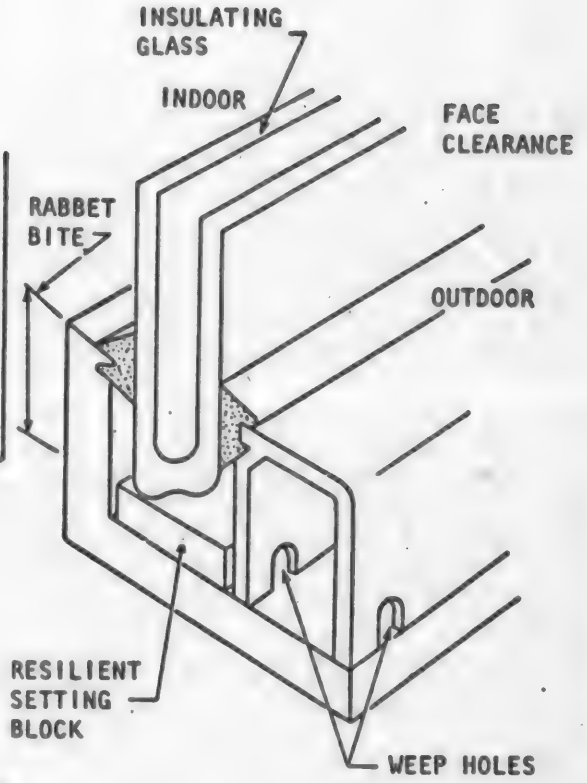


Figure 3. Multi Glazing

[6450-01-M]

(d) *Safety Precautions.* (1) Do not install window or door devices which would restrict means of egress which are required by applicable codes and regulations.

(e) *Storm Window*— (1) *Pre-installation Inspection and Preparation.* (i) Examine the framing of the prime window to ensure that it is sound, free of decay, and will provide secure anchorage for the storm window frames.

(ii) Ensure that the frame contact areas are free of protrusions that would interfere with proper installation of the storm windows.

(iii) Measure the prime window or its opening in accordance with the manufacturer's instructions, measuring and noting if it is out of square or not in plane.

(iv) Ensure that the storm window is the correct size and type for the opening, including tolerances and provisions for adjustment to "out-of-squareness."

NOTE 1. aesthetically, it is desirable that the meeting rails or stiles of storm windows align with the meeting rails or stiles of the prime window.

(v) Ensure that the storm window has not been damaged during shipping or assembly.

(vi) Ensure that all edges of wooden storm windows have been finished with a sealer to prevent swelling or warping.

(vii) Ensure that exterior storm windows have adequate weep holes.

(2) *Installation Procedures.* (i) Do not install storm windows unless the pre-installation inspection and preparation has been carried out and any defects which were identified, as well as their caused, were eliminated.

(ii) Seal any edges of wood storm window frames that were cut or planed to fit the unit into the opening.

(iii) Position storm windows to provide a minimum gap of ½ inch (13 mm) between the prime and storm glass.

(iv) Where both the storm and prime windows are metal, either position the storm window frame so that it does not contact the prime window frame or secure a nonmetallic spacer between the prime and storm window frames.

NOTE 2. The following materials are examples of acceptable spacers: ¼ inch (6.4 mm) thick spacers of wood, vinyl, rubber, or high density polyurethane.

(v) Secure aluminum storm windows only with aluminum or stainless steel fasteners to avoid galvanic corrosion.

(vi) In exterior installed storm windows, seal the joints at jambs and head to resist rain penetration.

(vii) Seal indoor storm windows to provide greater air tightness than that of the prime window.

(3) *Post-Installation Inspection and Procedures.* (i) Ensure that all weep holes are clear and provide complete drainage of the sill area.

(ii) Check removable storm windows for ease of removal and reinstallation. Ensure that storm windows fit snuggly with minimal apparent opportunity for air leakage through perimeter cracks.

(iii) Ensure that operable storm sash moves freely within the storm frame and that all hardware operates properly.

(f) *Thermal Windows*—(1) *Pre-Installation Inspection and Preparation.*—(i) Examine the existing window opening for signs of decay. Do not install thermal windows where the framing material is deteriorated.

(ii) Measure the window opening in accordance with the manufacturer's instructions, measuring and noting if it is out of square or not in plane.

(iii) Check for water damage to interior finishes. If water damage is found to be caused by leakage from the outside, as opposed to condensate, locate the source of the leakage and established whether replacing the window will correct the problem. If replacing the window will not correct the problem, take necessary corrective measures prior to installing the thermal window.

(iv) Ensure that the thermal windows are the correct size and type for the openings, including tolerances and provisions for adjustments to "out-of-squareness".

(v) Ensure that no thermal windows are damaged and, where sealed glass units are used, that their inside surfaces are free of condensation, fogging, or staining.

(vi) Ensure that the frames are free of any burrs or splinters, that the sash operates freely within the frame and latches securely, and that the weatherstripping is properly installed in all locations specified.

(2) *Installation Procedures.* (i) Do not install thermal windows unless the preinstallation inspection and preparation has been carried out and any defects which were identified, as well as their causes, have been eliminated.

(ii) Remove the existing window in a manner that will minimize damage to the remaining construction. Remove all fasteners and clear the frame opening of obstructions or protrusions that would interfere with the installation of the thermal window.

(iii) Examine exposed wall frame and remaining window construction and replace unsound material.

(iv) Where the existing window openings are reframed to a smaller size, insulate the voids between framing members and the window. Install a vapor barrier on the winter warm side of the insulation and provide interior and exterior coverings compatible with the existing construction.

(v) Install flashing at the head, jambs, and sill of the window as required to preclude the penetration of water into the wall cavity.

(vi) Anchor the unit in accordance with the manufacturer's instructions. Ensure that clearances specified in the manufacturer's instructions are maintained.

(vii) For aluminum units use only aluminum or stainless steel anchors and fasteners.

(viii) Shim the thermal window as necessary to ensure it is plumb, square and level.

(ix) Separate metal thermal window from incompatible materials (such as siding or frames of dissimilar metals) in the structure or frame with a nonmetallic spacer (see Note 2).

(x) Pack all gaps of ¼ inch (6.4 mm) or more with backup or filler materials such as nonabsorbing foam or sponge before installing sealant.

(xi) Seal the joints between the wall framing and window frame, using a high quality caulk such as acrylic, butyl, polyethylene, polysulfide, polyurethane, or silicone.

(3) *Post-Installation Inspection.* (i) Ensure that the sash moves freely within the frames and that all hardware operates correctly.

(ii) Ensure that the window frame and sash are square, plumb, and level.

(iii) Ensure that all weatherstripping makes full contact with mating surfaces.

(g) *Multi-Glazing—Sealed Insulating Glass.*—(1) *Pre-Installation Inspection and Preparation.* (i) Measure the opening for the multi-glazed unit in accordance with the manufacture's instuctions. Measure and note if it is out of square or not in plane.

(ii) Inspect the opening to ensure that there are no burrs, dirt, or deformation of glazing channels which may cause stress concentrations in the glass.

(iii) Ensure that weep holes or slots are not clogged.

(iv) Ensure that clearances and nominal "bite" (containment of the glass) are as specified by the manufacturer.

(v) During handling place cushioning material between the glass and hard materials, and do not set the glass on hard surfaces or turn it on its corners. This can damage the glass or seal, or both.

(vi) Ensure that neither the glass nor the edge seal are damaged, and that the units exhibit no signs of fogging and condensation. Do not install defective units.

(2) *Installation Procedures.* (i) Free Glazed Systems.

(A) Do not install multi-glazing sealed insulating glass units unless the pre-installation inspection and preparation has been carried out and any defects which were identified, as well as their causes, were eliminated.

(B) Prior to setting the glass, place two identical setting blocks of a resilient material at the quarter points of the glass. Use blocks that are narrower than the full channel width but that are at least 1/16 in. (1.6 mm) wider than the insulating glass and high enough to ensure minimal edge clearance but provide required bite for the glass.

NOTE 3. Install insulating glass units containing heat absorbing or reflective glass so that the heat absorbing or reflective sheet is the outermost sheet. This allows the heat absorbing glass to radiate the greater part of absorbed heat to the outdoors, and the reflective glass to reflect the greater part of the impinging solar radiation to the outdoors. Follow all additional precautions for installation prescribed by the manufacturer of the heat absorbing or reflective glass.

(C) Where necessary, set jamb blocks in place before installing glass to ensure proper horizontal positioning of the glass. Maintain recommended clearances and bite.

(D) Use only continuous resilient spacers to maintain face clearances. Do not use intermittent shims.

(E) Install only glazing sealants that are resilient, nonhardening compounds, tapes, or gaskets. Install only those sealants specified by the manufacturers of the unit.

(ii) Channel (Marine) Glazed Systems.

(A) Apply the wrap-around vinyl in one piece around the entire perimeter of the sealed insulating glass, ensuring that the glass is engaged by the full channel depth of the wrap-around vinyl. Ensure that the seam in the wrap-around vinyl occurs at the head of the unit.

(B) Clip off corner bulges of wrap-around vinyl to provide a continuous flush surface.

(C) Install glazing compounds and gaskets with a slope to ensure rainwater runoff.

(D) See Note 3 with respect to heat absorbing or heat reflective glass.

(3) *Post-Installation Inspection.* (i) Ensure that weep holes are not blocked.

(ii) Ensure that gaskets and sealants are properly installed.

(h) *Multi-Glazing—Unsealed Insulating Glass.* (1) Various innovative products are now being marketed that permit the installation of multi-glazing other than through the use of sealed insulating glass. Since the products, systems, and methods in such innovative applications differ widely, no generally applicable installation instructions can be given. However, the principles given under paragraphs (e), (f), and (g) of this section must be considered and the manufacturer's installation instructions followed.

(i) *Storm Doors*—(1) *Pre-Installation Inspection and Preparation.* (i) Examine the framing of the prime door to ensure that it is sound, free of decay, and provides secure anchorage for the storm door.

(ii) Ensure that the frame contact areas are free of protusions that would interfere with proper installation of the storm door.

(iii) Measure the door opening in accordance with the manufacturer's instructions, measuring and noting if it is out of square or not in plane.

(iv) Ensure that the storm door is the correct size and type for the opening, including tolerances and provisions for adjustment to "out-of-squareness."

(v) Ensure that the storm door has not been damaged.

(vi) Ensure that adequate weepage is provided on exterior storm doors.

(2) *Installation Procedure.* (i) Do not install storm doors unless the pre-installation inspection and preparation has been carried out and any defects which were identified, as well as their causes, have been eliminated.

(ii) If required for proper fit, adjust the storm doors or their frames to the size and "out-of-squareness" of prime door frames.

(iii) If a wood storm door requires planning or cutting of the wood frame or door, finish the cut edges with a sealer to prevent swelling and warping.

(iv) Anchor the storm doors to the framed openings in accordance with the manufacturer's instructions. Secure aluminum storm doors only with aluminum or stainless steel fasteners to avoid galvanic corrosion.

(v) Install the door catches, closers, and chains in accordance with the manufacturer's instructions.

(vi) Install weatherstripping in accordance with the manufacturer's instructions.

(vii) Maintain a gap of at least 1/16 in. (1.6 mm) between the storm door and the frame openings unless otherwise specified by the manufacturer.

(viii) For an expander type aluminum storm door, ensure that the expander edges are flush with the frame opening. Secure the expander edges using hardware and fasteners compatible with aluminum.

(ix) Do not use excessive force when installing the storm door frame of a pre-hung door into the door opening. Seal the joint between the storm door frame of a pre-hung storm door and the framed opening to prevent rain penetration.

(3) *Post-Installation Inspection and Procedures.* (i) Ensure that adequate drainage is provided to prevent water accumulation at the sill.

(ii) Ensure that the storm door operates freely and does not bind when closed.

(iii) Ensure that the weatherstripping is installed properly and forms a weathertight seal.

(iv) Ensure that the closer and chain assemblies operate properly, that the door handles and latch assemblies properly secure and lock the storm door, and that hardware of the storm doors does not interfere with the operation of the prime doors.

(j) *Thermal Doors*—(1) *Pre-Installation Inspection and Preparation.* (i) Examine the framing of the prime door to ensure that it is sound, free of decay or corrosion, and provides secure anchorage for the thermal door and frame.

(ii) Ensure that the frame contact areas are free of protrusions that would interfere with the proper installation of the thermal door and frame.

(iii) Measure the door opening in accordance with the manufacturer's instructions, measuring and noting if it is out of square or not in plane.

(iv) Ensure that the thermal door is the correct size and type for the opening, including tolerances and provisions for adjustment to "out-of-squareness."

(v) Ensure that the thermal door has not been damaged.

(2) *Installation Procedure.* (i) Do not install thermal doors unless the pre-installation inspection and preparation has been carried out and any defects which were identified, as well as their causes, have been eliminated.

(ii) If required for proper fit, adjust the thermal door frame by shimming the frame to the size and "out-of-squareness" of the door opening.

(iii) Anchor the thermal door frame to the door openings in accordance with the manufacturer's instructions. Secure steel thermal door frames with steel fasteners and aluminum thermal doors with aluminum fasteners to avoid galvanic corrosion.

(iv) Do not use excessive force when installing the thermal door frame of a pre-hung door into the door opening. Seal the joint between the thermal door frame of a pre-hung thermal door and the framed opening to prevent rain penetration.

(v) Anchor the thermal door to the framed opening in accordance with the manufacturer's instructions.

(vi) Maintain a gap of at least 1/16 inch (1.6 mm) between the thermal door and the framed opening unless otherwise specified by the manufacturer.

(vii) If the sill does not seal tightly against the bottom cap of the thermal door replace the sill.

(3) *Post-Installation Inspection and Procedures.* (i) Ensure that adequate drainage is provided to prevent water accumulation at the sill.

(ii) Ensure that the thermal door operates freely and does not bind when closed.

(iii) Ensure that weatherstripping is installed properly and forms a weathertight seal.

(iv) Ensure that door catches, handles, and latch assemblies properly secure and lock the thermal door, and, where there is a storm door, that the hardware of the thermal door does not interfere with the operation of the storm door.

**§ 456.911 Standard Practice for the Installation of Clock Thermostats.**

(a) *Scope.* (1) This practice covers the installation of clock thermostats for controlling space conditioning systems.

(2) This practice covers the installation process from pre-installation inspection through post-installation inspection.

(3) This practice is not intended to replace the manufacturer's installation instructions unless they are inconsistent with this practice.

(4) This practice is not intended to supersede the authority of local codes and regulations unless the requirements of such codes and regulations are less stringent than those prescribed herein.

(5) This practice requires that the person installing the insulation have a good working knowledge of the applicable codes and regulations, tools, equipment, and methods necessary for the installation of clock thermostats and of heating and air conditioning systems in general, or in the alternative, that the person supervising the installer have such knowledge. It also requires an understanding of fundamentals of residential construction that affect the installation of clock thermostats.

(6) This practice requires that any wiring of thermostat circuits other than Class 2 circuits be carried out by an approved electrician except as noted in paragraph (e)(2) of this section.

(7) This practice covers aspects of installation relating to the effectiveness, durability, and safety of the clock thermostat in service.

(8) This practice provides minimum requirements that will help to ensure installation of the clock thermostat in a safe and effective manner. It must be noted that actual conditions in existing buildings vary greatly and in some cases substantial additional care and precaution may have to be taken to ensure effective and safe installation.

(b) *Significance.* (1) This practice recognizes that the safe and effective operation of a clock thermostat depends not only on the quality of the device but also on its proper and workmanlike installation.

(2) Improper installation of a clock thermostat may defeat the purpose of its installation, i.e., to minimize space heating and/or cooling equipment operation with minimum loss of comfort.

(3) Improper installation in applications that require electrical wiring or the addition of power supplies may result in fire hazards, electric shock, and malfunction or failure of the heating and/or cooling equipment.

(c) *Safety Precautions.* (1) Follow the manufacturer's installation instruction pertaining to safety.

(2) When the installation requires any electrical connections, additional wiring, or electrical components, disconnect any and all circuits supplying electrical power to the thermostat and electrically connected devices (i.e., heating and/or cooling unit) at the supply. Where any individuals other than the installer have access to the switches, circuit breakers, or fuses that disconnect these electrical circuits, properly mark and assure that such switches, circuit breakers, or fuses are held open and disconnected until the installation is complete.

(d) *Pre-Installation Inspection and Preparation.* (1) Determine the type of heating system which serves the residential building. Do not install a clock thermostat in any building which uses a heat pump as the primary heat source.

(2) Determine whether the thermostat circuit is a Class 2 thermostat circuit. Only an approved electrician may install a clock thermostat to a circuit which is not a Class 2 circuit. Add on/plug in clock thermostats not connected to the thermostat circuit may be installed by persons other than an approved electrician regardless of type of circuit used.

NOTE 1.—Class 2 power supply units are marked to indicate the class of supply and electrical rating.

(3) Determine whether the characteristics of the clock thermostat are compatible with the requirements of the heating and/or cooling system with regard to voltage, current ratings, and modes of operation.

NOTE 2.—One characteristic of the compatibility of the heating system and replacement clock thermostat is the heat anticipator setting. The proper setting can be determined in 3 ways:

a. Check heat anticipator setting of the existing thermostat and adjust the heat anticipator setting of the replacement thermostat to the same setting.

b. Consult the manufacturer of the heating system.

c. Measure the current through the thermostat circuit and place the heat anticipator setting of the replacement thermostat to the same setting.

(4) When the clock thermostat is to be installed in a location other than that of the thermostat which it replaces, locate the device between 4 and 5½ feet above floor level and not near a heat source such as in direct sunlight, near lamps, fireplaces, stoves, heat registers, radiators, heat-producing appliances or on walls with heating ducts, steam, or hot water pipes directly behind them; or near cold areas such as outside walls, windows, areas subject to drafts, walls of unheated rooms or garages, walls with cold water pipes, or cooling ducts directly behind them, or near doors to the outside; or in areas that receive poor air circulation, such as closets, room corners, behind furniture, drapes or behind opened doors.

(e) *Installation Procedures.* (1) Do not install the clock thermostat unless the pre-installation inspection and preparation has been carried out.

(2) Install the clock thermostat in strict accordance with the manufacturer's installation instructions and these installation practices except where local codes and regulations are more stringent.

(3) Install circuit conductors (on electrical units only) in a manner that will prevent their accidental grounding or shorting.

(4) Install the thermostat on a flat, firm, vertical surface to ensure that the functioning of the device is not impaired.

(5) Level the device to assure that the thermostat functions properly.

(6) When the unit requires electrical wiring and is classified as a Class 2 thermostat circuit, separate any conductors for that circuit by at least two inches from the conductors of any light or power circuit, except where that light or power circuit is permanently separated from the Class 2 thermostat circuit by a firmly fixed non-conductor or where it is in a protective cable or conduit.

(7) Do not place conductors of Class 2 circuits in any enclosure or compartment with conductors of light or power circuits unless the conductors of different circuits are separated by a partition, or the other conductors in the outlet boxes, junction boxes or similar fittings are there solely to supply power to thermostat circuit controls.

(8) Install conductors of Class 2 thermostat circuits in any hoistway in rigid conduit, intermediate metal conduit, or electrical metallic tubing.

(9) In any shaft or vertical run install only conductors for Class 2 circuits which have a fire resistant covering.

(10) Install only conductors which are of a size and have electrical insula-

tion which is suitable for the particular application.

(11) When the unit requires a transformer to supply power to a Class 2 thermostat circuit, install only a transformer which is within the power limit of Class 2 circuits either through its inherent current limiting impedance or by means of the supply limitation and an overcurrent protection device.

(12) Install only Class 2 transformers which are plainly marked by the manufacturer as power-supplies for Class 2 thermostat circuits.

(13) When the unit requires a new or replacement transformer to supply power to a Class 2 thermostat circuit, the conductors and equipment on the supply side shall be wired by a approved electrician according to standard electrical power circuit practice as outlined in the appropriate section of Chapter 3 of the National Electrical Code.

(f) *Post-Installation Inspection and Procedures.* (1) Ensure that the unit has been installed according to the manufacturer's instructions and this section except where local codes and regulations are more stringent.

(2) Ensure that the unit is operational for its specific applications.

(3) Provide any warranty cards and instructional material on the use of the device that accompanied the unit.

**§ 456.912 Standard Practice for the Installation of Insulation on Gas-Fired, Oil-Fired, and Electric Resistance Water Heaters.**

(a) *Scope.* (1) This practice covers the installation of insulation around gas-fired, oil-fired, and electric resistance water heaters.

(2) This practice applies only to the installation of mineral fiber blanket thermal insulation materials.

(3) This practice covers the installation process from pre-installation inspection through post-installation inspection. It does not cover the production of the insulation materials.

(4) This practice is not intended to replace the manufacturer's installation instructions unless they are inconsistent with this practice.

(5) This practice is not intended to supersede the authority of state and local codes and regulations unless the requirements of such codes and regulations are less stringent than those prescribed herein.

(6) This practice requires that the person installing the insulation have a working knowledge of the applicable codes and regulations, tools, equipment, methods necessary for the installation of thermal insulation materials and water heaters in general or, in the alternative, that the person supervising the installer have such knowledge.

(7) This practice covers aspects of installation relating to the effectiveness, durability, and safety of the insulation in service.

(8) This practice provides minimum requirements that will help to ensure the installation of water heater insulation in a safe and effective manner. It must be noted that actual conditions vary greatly and in some cases additional care and precaution may have to be taken to ensure effective and safe installation.

(b) *Significance.* (1) This practice recognizes that effectiveness, safety, and durability of water heater jacket insulation depend not only on the quality of the materials, but also on their proper and workmanlike installation.

(2) Improper installation of insulation may reduce its thermal effectiveness, cause fire hazards and other unsafe conditions.

NOTE 1. Specific hazards that can result from improper installation of water heater insulation include fire, water damage and the release of toxic gases.

(c) *Pre-Installation Inspection and Preparation*—(1) *General.* Determine the fuel type (gas, electric, oil) of the water heater.

(2) *Electric Resistance Water Heater.* Determine the location of the pressure relief valve, thermostat control, and hi-limit switch (see Figure 1).

(3) *Gas-Fired Water Heater.* (i) Determine whether the gas-fired water heater is equipped with a flue damper. Do not insulate gas-fired water heaters so equipped.

(ii) Determine the location of the pressure relief valve and draft hood on top of the water heater (see Figure 2).

(iii) Determine the location of the burner air inlet, pilot light access plate, and drain valve (see Figure 2).

(4) *Oil-Fired Water Heater.* (i) Determine the location of the pressure relief valve, flue pipe, and barometric draft gauge (see Figure 3).

(B) Determine the location of the thermostat control, peep sight and drain valve (see Figure 3).

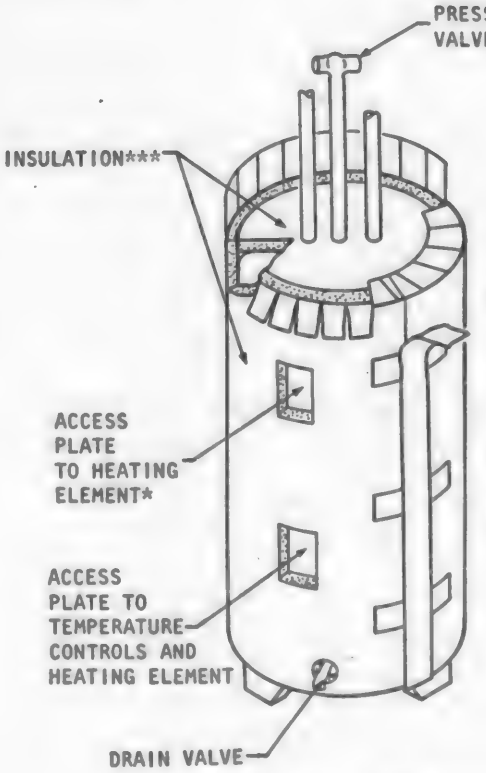


Figure 1. Electric Water Heater

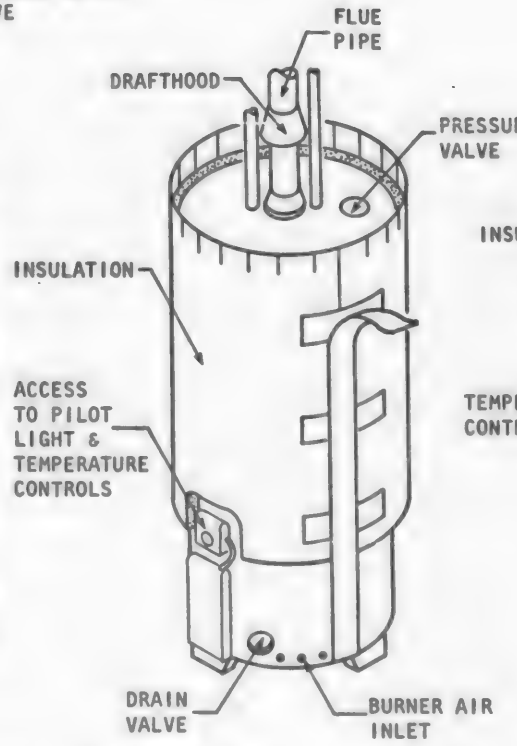


Figure 2. Gas-Fired Water Heater

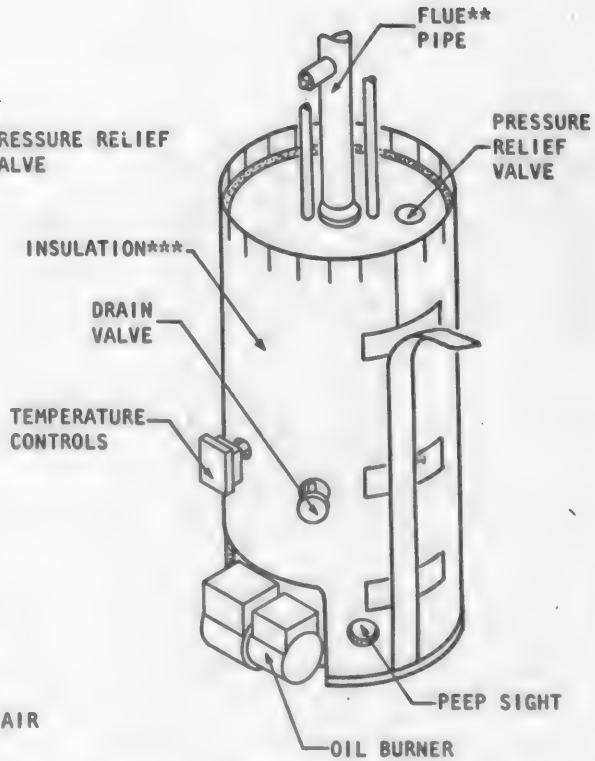


Figure 3. Oil-Fired Water Heater

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* Only found on water heaters with two heating elements.

** The pipe may be side-mounted.

***Top insulated on all electric water heaters and oil-fired water heaters with side-mounted flue pipes.

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(d) *Installation Procedures*—(1) *General.* (i) Do not install insulation unless the pre-installation inspection and preparation has been carried out.

(ii) Handle insulation in accordance with manufacturer's instructions and keep dry and free of extraneous materials.

(iii) Apply the insulation to the water heater with the facing to the outside.

(iv) Secure the sections of insulation to the water heater using a tape of the size and type recommended by the insulation manufacturer.

(2) *Electric Resistance Water Heater.* (i) Install insulation on the sides and top plate of the water heater.

(ii) Cut the insulation to leave holes for the pressure relief valve, thermostat control, hi-limit switch, plumbing pipes and other necessary access plates.

(3) *Gas-Fired Water Heater.* (i) Do *not* install insulation on the top plate of gas-fired water heaters.

(ii) Cut the insulation to leave holes for the burner air inlet, thermostat control, pilot light access plate, drain valve, plumbing pipes and other necessary access plates.

(4) *Oil-Fired Water Heaters.* Do not install insulation closer than four inches from a side-mounted flue pipe.

(ii) If the flue pipe is top-mounted do *not* install insulation on the top plate of the water heater.

(iii) Cut the insulation to leave holes for the pressure relief valve, thermostat control, flame peep sight, burner access plate, drain valve, plumbing pipes and other necessary access plates.

(e) *Post-Installation Inspection Procedures.* (1) Ensure that all water heater surfaces, except those indicated herein, have been covered with insulation.

(2) Ensure that no air inlets, access plates, drain valves, temperature controls and pressure relief valves are covered by insulation.

(3) Ensure that all insulation sections have been properly attached and sealed with tape.

**§ 456.913 Standard Practice for the Installation of Replacement Oil Burners for Energy Conservation.**

(a) *Scope.* (1) This practice provides minimum requirements for the installation of replacement oil burners for the purpose of significantly reducing the amount of fuel oil consumed by increasing combustion efficiency and reducing firing rate. It is intended for use on warm air, hot water, and steam systems, but does not cover firing rate reductions for steam heating systems. This is because steam boilers are considerably less flexible in accepting firing rate modifications than hot air or hot water furnances because of the boilers' need to provide the rate of steam generation required to obtain suitable steam distribution throughout the system.

(2) This practice covers the installation process from pre-installation inspection for inefficient operation through post-installation tune-up for best efficiency. Special considerations for maximizing system efficiency are emphasized.

(3) This practice is not intended to replace the burner manufacturer's installation instructions unless they are inconsistent with this practice. It is intended to supplement the manufacturer's instructions where the latter are less stringent than those prescribed herein and to supersede the manufacturer's instructions in matters of efficiency.

(4) This practice is intended for use by approved installers. It outlines the general procedure to be followed, but leaves the detailed step-by-step methodology to the approved installers. It is therefore not intended for use by the general public or by untrained persons, since such use may be unsafe or result in damaged equipment.

(5) This practice covers aspects of installation relating to the effectiveness, durability, and safety of replacement oil burners in service.

(6) This practice does not supersede the authority of local codes and regulations unless the requirements of such codes and regulations are less stringent that those prescribed herein.

(7) This practice requires that the person installing the insulation have a working knowledge of the applicable codes and regulations, tools, equipment, and methods necessary for the installation of replacement oil burners or, in the alternative, that the person supervising the installer have such working knowledge. It also requires an understanding of the fundamentals of residential construction that affect the installation of replacement oil burners.

(b) *Significance.* (1) This practice recognizes that substantial amounts of fuel oil can be conserved by replacing burners that are inefficient through design, wear, or extreme oversizing with respect to the building's heating requirements with new, properly sized, high-efficiency burners.

(2) This practice recognizes that effectiveness, safety and durability of replacement oil burners depends not only on the quality of the materials but also on their proper and workmanlike installation.

(3) This practice Improper installation of replacement oil burners may reduce their effectiveness, and contribute to fire hazards and other unsafe conditions.

(c) *Evaluation of Existing Burner.* (1) Seal air leaks around burner tube, clean-out doors, secondary air dampers and firing doors on converted coal burners.

(2) Adjust air gate to give a smoke reading of #1 or greater when measured in accordance with the proceddure outlined in American National Standard ANSI/ASTM D2156–65 (1975) (after subparagraph (3) of this paragraph has been completed, restore burner to a smoke reading of #1 or less).

(3) Start the burner and allow it to run at least 15 minutes to reach a steady state operating condition. Measure the flue gas temperature and the percentage of $CO_2$ in the flue gas through a ¼" diameter hole in the flue located between the barometric draft regulator and the furance flue outlet.

(4) Using Figures 1 or 2 in Appendix D, determine the steady state efficiency of the furnace from the flue gas temperature and percent $CO_2$ concentration. As an alternative, steady state efficiency may be calculated using the procedures given in Appendix C.

(d) *Replacement Criteria.* (1) Replace the burner if the estimated savings resulting from installation of a more efficient burner will pay for the cost of the replacement burner. If the savings calculated in subparagraph (2) of this paragraph multiplied by the desired payback period in years exceed the total cost of burner replacement (labor plus parts), the burner should be replaced.

(2) Table 1 shows the annual dollar savings per $100 of annual fuel costs that can be achieved by increasing furnace efficiency. Note that as fuel prices increase, the payback period will become shorter.

TABLE 1.—*Annual Dollar Savings Per $100 of Annual Fuel Cost as a Result of Increased Furance Efficiency*

| From original efficiency of | To an increased efficiency of | | | | | | |
|---|---|---|---|---|---|---|---|
| | 74% | 76% | 78% | 80% | 82% | 84% | 86% |
| 50% | $32.40 | $34.20 | $35.90 | $37.50 | $37.50 | $40.50 | $41.90 |
| 52% | 29.70 | 31.50 | 33.30 | 35.00 | 36.60 | 38.10 | 39.50 |
| 54% | 27.00 | 28.90 | 30.80 | 32.50 | 34.10 | 35.70 | 37.20 |
| 56% | 24.30 | 26.20 | 28.20 | 30.00 | 31.70 | 33.30 | 34.80 |
| 58% | 21.60 | 23.70 | 25.60 | 27.50 | 29.20 | 31.00 | 32.60 |
| 60% | 18.90 | 21.10 | 23.10 | 25.00 | 26.80 | 28.60 | 30.20 |
| 62% | 16.20 | 18.40 | 20.50 | 22.50 | 24.40 | 26.20 | 27.90 |
| 64% | 13.50 | 15.80 | 17.90 | 20.00 | 22.00 | 23.80 | 25.60 |
| 66% | 10.80 | 13.20 | 15.40 | 17.50 | 19.50 | 21.40 | 23.30 |
| 68% | 8.10 | 10.50 | 12.80 | 15.00 | 17.10 | 19.00 | 20.90 |
| 70% | 5.40 | 7.90 | 10.20 | 12.50 | 14.60 | 16.70 | 18.60 |
| 72% | 2.70 | 5.30 | 7.70 | 10.00 | 12.20 | 14.30 | 16.30 |
| 74% | | 2.60 | 5.10 | 7.50 | 9.80 | 11.90 | 14.00 |
| 76% | | | 2.60 | 5.00 | 7.30 | 9.50 | 11.60 |

The original furnace efficiency is the value calculated in paragraph (c)(4) of this section. The efficiency of the furnace with a new burner conforming to the requirements of ANSI Z91.2 may be estimated by assuming a stack $CO_2$ concentration of 10 percent and a stack temperature equal to that measured in paragraph (c)(3) of this section. If the burner manufacturer specifies a $CO_2$ concentration greater than 10 percent for his burner when tested in accordance with ANSI Z91.2, this should be used instead of the minimum value of 10 percent which the ANSI standard requires.

As an example, if the original stack conditions were six percent $CO_2$ and 500° F. (72 percent efficiency) (Instructions for calculating furnace efficiency are given in Appendix C) and the manufacturer of the replacement burner stated that 12 percent $CO_2$ was obtainable with his burner, the assumed new conditions with the replacement burner installed would be 12 percent $CO_2$ and 500° F. (81 percent efficiency). Using these two values an estimated annual saving of $11.10 per $100 of annual fuel cost can be read. If the annual fuel costs were $500, the annual savings would be $11.10×5=$55.50. If the desired payback period were seven years, the total savings justifying burner replacement would be $55.50×7=$388.50. In this example the burner should be replaced if the total replacement (labor plus parts) cost is less than $388 and should not be replaced if the total replacement cost is more than $388.

Use an additional average savings of $5.80 per $100 of annual fuel cost in the payback period calculation if the firing rate of the new burner is optimized as described in paragraph (e)(1) of this section and the resulting value is smaller than the original firing rate by 20 percent or more (see paragraph (e)(1) of this section).

(e) *Selection of Replacement Burner.* (1) Determine design nozzle size. Using the local outdoor design temperature for the area and the measured average winter K-factor for the residence (degree days per gallon) determine the minimum nozzle size by the formula:

$$\text{minimum nozzle size} = \frac{(65 - T_D)}{(\text{K-factor})(24)} \times \frac{\text{Efficiency of Furnace Measured in (o)(4)}}{\text{Expected Efficiency of furnace with New Burner as calculated in (d)(2)}}$$

Where $T_D$ is the local outdoor design temperature in ° F and the K-factor is in degree days per gallon of oil.

If the outdoor design temperature is not known, refer to Chapter 33 of the ASHRAE Handbook of Fundamentals. Use the 97.5 percent values for the nearest weather station listed.

The winter K-factor is an average value derived over one or more complete heating seasons. The K-factor for a residence is defined as the number of degree days occurring in a time period divided by the total number of gallons of oil used during the same period to maintain a house at its normal thermostat setting. Determine from the occupant whether storm windows or a substantial amount of new insulation has been installed since the last heating season. If so, the calculation of the K-factor with the above formula may be too high.

If the heat requirement of the house has been significantly reduced by insulation or storm windows, it may also be possible to reduce the cut-off set point of the aquastat on hot water boilers by 10 to 20° F. to reduce standby heatr losses. This setback may not be able to be done, however, if the boiler is used to heat domestic hot water.

Thermostat setback is to be encouraged as an additional energy conservation measure. If the owner plans to practice nighttime setback, in order to insure adequate temperature recovery, increase the size of the burner replacement nozzle by adding a value in gallons per hour equal to the heated house floor area in square feet, times the pickup capacity factor (PCF), divided by 140,000, where PCF is given by the following table:

| Outdoor design temperature, °F | Pickup capacity factor, Btu/hour/sq. foot floor area |
|---|---|
| 40 | 9.5 |
| 30 | 13.0 |
| 20 | 14.3 |
| 10 | 15.6 |
| 0 | 17.0 |
| −10 | 17.7 |
| −20 | 18.5 |

Select a nozzle that gives the spray pattern and angle recommended by the manufacturer of the replacement burner that is not larger than the original nozzle.

(2) Choose the replacement burner recommended by its manufacturer for use with the design nozzle size calculated in subparagraph (1) of this paragraph.

(3) Do not select a flame retention replacement burner for use on a hot water or steam boiler equipped with stainless steel tubes. Higher temperature levels produced by high performance flame retention burners may cause the combustion chamber to burn out.

(f) *Installation Replacement Burner.* (1) Install fixed firing rate replacement burners with a nozzle of the size calculated in paragraph (e)(1) of this section.

(2) Replace the burner in accordance with the manufacturer's instructions following normal, good installation practices.

(3) It is anticipated that most burner replacements will involve replacing a conventional burner with a high speed, flame retention head burner. If this is done, a new furnace liner designed for this application may have to be installed since flame retention burners operate at higher temperatures (2300° F vs. 1800° F) than conventional burners and could cause damage to a firebox refractory designed for use with conventional burners.

(4) Ensure that the completed installation is in conformance with all local and state building and fire safety codes. Where local codes do not exist, verify conformance with American National Standard Installation of Oil Burning Equipment, Z95.1-1974 (NFPA No. 31—1974).

(5) Test-operate the installed burner and measure its efficiency following the guidelines of U.S. Environmental

Protection Agency Report No. EPA 600/2-75-069a (October 1975), "Guidelines for Residential Oil Burner Adjustments." If the replacement burner results in an appreciable reduction in stack temperature, the stack switch heat controls (if the unit is so equipped) for ignition cutoff may need to be readjusted.

(6) The temperature of the combustion gases entering the draft regulator must be at least 370° F for chimneys enclosed within the insulated structure to prevent condensate and subsequent corrosion. The temperature of the combustion gases entering the draft regulator if 2 or 3 sides of the chimney are exposed to an outdoor ambient design temperature of 0° F or less to prevent condensation and freezing within the chimney. If the temperature of the combustion gases entering the draft regulator is below the specified minimum value, fit a larger nozzle to increase that temperature.

(g) *Data to be Recorded.* (1) Record the following information and leave a copy with the owner and on a tag attached to the equipment.

(i) Date of replacement

(ii) Identity of installing mechanic and company

(iii) The original burner make, model, model number, and nozzle size

(iv) The replacement burner make, model number, and nozzle size

(v) The number and size of any additional nozzles tried in the replacement burner

(vi) Other modifications to the unit

(vii) The initial and final $CO_2$ net stack temperature, efficiency, and smoke readings.

(2) This information will be helpful for future servicing of the unit and in troubleshooting any problems which arise immediately after burner replacement and/or firing rate reduction.

**§ 456.914 Standard Practice for the Installation of Urea-Formaldehyde Foam Insulation. [Reserved.]**

**§ 456.915 Standard Practice for the Installation of Pipe Insulation. [Reserved.]**

**§ 456.916 Standard Practice for the Installation of Vent Dampers and Electronic Ignition Devices. [Reserved.]**

APPENDIX A TO SUBPART I, PART 456

ASTM AND ANSI STANDARDS

1. "ASTM" means the American Society for Testing and Materials. ASTM is a scientific and technical organization formed for "the development of standards on characteristics and performance of materials, products, systems, and services, * * *." ASTM standards are available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

2. ASTM Designation C168-67 means "Standard Definitions of Terms Relating to Thermal Insulating Materials."

3. ASTM Designation C755-73 means "Standard Recommended Practice for Selection of Vapor Barriers for Thermal Insulation."

4. ASTM Designation E84-77 means "Standard Test Method for Surface Burning Characteristics of Building Materials."

5. ASTM Designation E119-76 means "Standard Methods of Fire Tests of Building Construction and Materials."

6. "ANSI" means American National Standards Institute.

7. ANSI Z96.2-1974 (UL 296-Sept. 1974) means "American National Standard Safety Standard for Oil Burners."

8. ANSI Z91.2-1976 means "American National Standard Performance Requirements for Automatic Pressure Atomizing Oil Burners of the Mechanical Draft Type."

9. ANSI/AS9M D2156-65 (1975) means "American National Standard Method of Tests for Smoke Density in the Flue Gases from Distillate Fuels."

[6450-01-C]

## APPENDIX B TO SUBPART I. PART 456

### NATIONAL ELECTRIC CODE TABLES 310-16 THROUGH 310-19*

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### Table 310-16. Allowable Ampacities of Insulated Conductors Rated 0-2000 Volts, 60° to 90°C

Not More Than Three Conductors in Raceway or Cable or Earth (Directly Buried), Based on Ambient Temperature of 30°C (86°F)

| Size | Temperature Rating of Conductor. See Table 310-13 | | | | | | | | Size |
|---|---|---|---|---|---|---|---|---|---|
| | 60°C (140°F) | 75°C (167°F) | 85°C (185°F) | 90°C (194°F) | 60°C (140°F) | 75°C (167°F) | 85°C (185°F) | 90°C (194°F) | |
| AWG MCM | TYPES RUW, T, TW, UF | TYPES FEPW, RH, RHW, RUH, THW, THWN, XHHW, USE, ZW | TYPES V, MI | TYPES TA, TBS, SA, AVB, SIS, †FEP, †FEPB, †RHH, †THHN, †XHHW* | TYPES RUW, T, TW, UF | TYPES RH, RHW, RUH, THW, THWN, XHHW, USE | TYPES V, MI | TYPES TA, TBS, SA, AVB, SIS, †RHH, †THHN, †XHHW* | AWG MCM |
| | COPPER | | | | ALUMINUM OR COPPER-CLAD ALUMINUM | | | | |
| 18 | .... | .... | .... | 21 | .... | .... | .... | .... | .... |
| 16 | .... | .... | .... | 22 | .... | .... | .... | .... | .... |
| 14 | 15 | 15 | 25 | 25 | .... | .... | .... | .... | .... |
| 12 | 20 | 20 | 30 | 30 | 15 | 15 | 25 | 25 | 12 |
| 10 | 30 | 30 | 40 | 40 | 25 | 25 | 30 | 30 | 10 |
| 8 | 40 | 45 | 50 | 50 | 30 | 40 | 40 | 40 | 8 |
| 6 | 55 | 65 | 70 | 70 | 40 | 50 | 55 | 55 | 6 |
| 4 | 70 | 85 | 90 | 90 | 55 | 65 | 70 | 70 | 4 |
| 3 | 80 | 100 | 105 | 105 | 65 | 75 | 80 | 80 | 3 |
| 2 | 95 | 115 | 120 | 120 | 75 | 90 | 95 | 95 | 2 |
| 1 | 110 | 130 | 140 | 140 | 85 | 100 | 110 | 110 | 1 |
| 0 | 125 | 150 | 155 | 155 | 100 | 120 | 125 | 125 | 0 |
| 00 | 145 | 175 | 185 | 185 | 115 | 135 | 145 | 145 | 00 |
| 000 | 165 | 200 | 210 | 210 | 130 | 155 | 165 | 165 | 000 |
| 0000 | 195 | 230 | 235 | 235 | 155 | 180 | 185 | 185 | 0000 |
| 250 | 215 | 255 | 270 | 270 | 170 | 205 | 215 | 215 | 250 |
| 300 | 240 | 285 | 300 | 300 | 190 | 230 | 240 | 240 | 300 |
| 350 | 260 | 310 | 325 | 325 | 210 | 250 | 260 | 260 | 350 |
| 400 | 280 | 335 | 360 | 360 | 225 | 270 | 290 | 290 | 400 |
| 500 | 320 | 380 | 405 | 405 | 260 | 310 | 330 | 330 | 500 |
| 600 | 355 | 420 | 455 | 455 | 285 | 340 | 370 | 370 | 600 |
| 700 | 385 | 460 | 490 | 490 | 310 | 375 | 395 | 395 | 700 |
| 750 | 400 | 475 | 500 | 500 | 320 | 385 | 405 | 405 | 750 |
| 800 | 410 | 490 | 515 | 515 | 330 | 395 | 415 | 415 | 800 |
| 900 | 435 | 520 | 555 | 555 | 355 | 425 | 455 | 455 | 900 |
| 1000 | 455 | 545 | 585 | 585 | 375 | 445 | 480 | 480 | 1000 |
| 1250 | 495 | 590 | 645 | 645 | 405 | 485 | 530 | 530 | 1250 |
| 1500 | 520 | 625 | 700 | 700 | 435 | 520 | 580 | 580 | 1500 |
| 1750 | 545 | 650 | 735 | 735 | 455 | 545 | 615 | 615 | 1750 |
| 2000 | 560 | 665 | 775 | 775 | 470 | 560 | 650 | 650 | 2000 |

CORRECTION FACTORS

| Ambient Temp. °C | For ambient temperatures over 30°C, multiply the ampacities shown above by the appropriate correction factor to determine the maximum allowable load current. | | | | | | | | Ambient Temp. °F |
|---|---|---|---|---|---|---|---|---|---|
| 31-40 | .82 | .88 | .90 | .91 | .82 | .88 | .90 | .91 | 86-104 |
| 41-50 | .58 | .75 | .80 | .82 | .58 | .75 | .80 | .82 | 105-122 |
| 51-60 | .... | .58 | .67 | .71 | .... | .58 | .67 | .71 | 123-141 |
| 61-70 | .... | .35 | .52 | .58 | .... | .35 | .52 | .58 | 142-158 |
| 71-80 | .... | .... | .30 | .41 | .... | .... | .30 | .41 | 159-176 |

†The load current rating and the overcurrent protection for these conductors shall not exceed 15 amperes for 14 AWG, 20 amperes for 12 AWG, and 30 amperes for 10 AWG copper; or 15 amperes for 12 AWG and 25 amperes for 10 AWG aluminum and copper-clad aluminum.

* For dry locations only. See 75°C column for wet locations.

### Table 310-17. Allowable Ampacities of Insulated Conductors Rated 0-2000 Volts, 60° to 90°C

Single conductors in free air, based on ambient temperature of 30°C (86°F).

| Size | Temperature Rating of Conductor. See Table 310-13 | | | | | | | | Size |
|---|---|---|---|---|---|---|---|---|---|
| | 60°C (140°F) | 75°C (167°F) | 85°C (185°F) | 90°C (194°F) | 60°C (140°F) | 75°C (167°F) | 85°C (185°F) | 90°C (194°F) | |
| AWG MCM | TYPES RUW, T, TW | TYPES FEPW, RH, RHW, RUH, THW, THWN, XHHW, ZW | TYPES V, MI | TYPES TA, TBS, SA, AVB, SIS, †FEP, †FEPB, †RHH, †THHN, †XHHW* | TYPES RUW, T, TW | TYPES RH, RHW, RUH, THW, THWN, XHHW | TYPES V, MI | TYPES TA, TBS, SA, AVB, SIS, †RHH, †THHN, †XHHW* | AWG MCM |
| | COPPER | | | | ALUMINUM OR COPPER-CLAD ALUMINUM | | | | |
| 18 | .... | .... | .... | 25 | .... | .... | .... | .... | .... |
| 16 | .... | .... | .... | 27 | .... | .... | .... | .... | .... |
| 14 | 20 | 20 | 30 | 30 | .... | .... | .... | .... | .... |
| 12 | 25 | 25 | 40 | 40 | 20 | 20 | 30 | 30 | 12 |
| 10 | 40 | 40 | 55 | 55 | 30 | 30 | 45 | 45 | 10 |
| 8 | 55 | 65 | 70 | 70 | 45 | 55 | 55 | 55 | 8 |
| 6 | 80 | 95 | 100 | 100 | 60 | 75 | 80 | 80 | 6 |
| 4 | 105 | 125 | 135 | 135 | 80 | 100 | 105 | 105 | 4 |
| 3 | 120 | 145 | 155 | 155 | 95 | 115 | 120 | 120 | 3 |
| 2 | 140 | 170 | 180 | 180 | 110 | 135 | 140 | 140 | 2 |
| 1 | 165 | 195 | 210 | 210 | 130 | 155 | 165 | 165 | 1 |
| 0 | 195 | 230 | 245 | 245 | 150 | 180 | 190 | 190 | 0 |
| 00 | 225 | 265 | 285 | 285 | 175 | 210 | 220 | 220 | 00 |
| 000 | 260 | 310 | 330 | 330 | 200 | 240 | 255 | 255 | 000 |
| 0000 | 300 | 360 | 385 | 385 | 230 | 280 | 300 | 300 | 0000 |
| 250 | 340 | 405 | 425 | 425 | 265 | 315 | 330 | 330 | 250 |
| 300 | 375 | 445 | 480 | 480 | 290 | 350 | 375 | 375 | 300 |
| 350 | 420 | 505 | 530 | 530 | 330 | 395 | 415 | 415 | 350 |
| 400 | 455 | 545 | 575 | 575 | 355 | 425 | 450 | 450 | 400 |
| 500 | 515 | 620 | 660 | 660 | 405 | 485 | 515 | 515 | 500 |
| 600 | 575 | 690 | 740 | 740 | 455 | 545 | 585 | 585 | 600 |
| 700 | 630 | 755 | 815 | 815 | 500 | 595 | 645 | 645 | 700 |
| 750 | 655 | 785 | 845 | 845 | 515 | 620 | 670 | 670 | 750 |
| 800 | 680 | 815 | 880 | 880 | 535 | 645 | 695 | 695 | 800 |
| 900 | 730 | 870 | 940 | 940 | 580 | 700 | 750 | 750 | 900 |
| 1000 | 780 | 935 | 1000 | 1000 | 625 | 750 | 800 | 800 | 1000 |
| 1250 | 890 | 1065 | 1130 | 1130 | 710 | 855 | 905 | 905 | 1250 |
| 1500 | 980 | 1175 | 1260 | 1260 | 795 | 950 | 1020 | 1020 | 1500 |
| 1750 | 1070 | 1280 | 1370 | 1370 | 875 | 1050 | 1125 | 1125 | 1750 |
| 2000 | 1155 | 1385 | 1470 | 1470 | 960 | 1150 | 1220 | 1220 | 2000 |

CORRECTION FACTORS

| Ambient Temp. °C | For ambient temperatures over 30°C, multiply the ampacities shown above by the appropriate correction factor to determine the maximum allowable load current. | | | | | | | | Ambient Temp. °F |
|---|---|---|---|---|---|---|---|---|---|
| 31-40 | .82 | .88 | .90 | .91 | .82 | .88 | .90 | .91 | 86-104 |
| 41-50 | .58 | .75 | .80 | .82 | .58 | .75 | .80 | .82 | 105-122 |
| 51-60 | .... | .58 | .67 | .71 | .... | .58 | .67 | .71 | 123-141 |
| 61-70 | .... | .35 | .52 | .58 | .... | .35 | .52 | .58 | 142-158 |
| 71-80 | .... | .... | .30 | .41 | .... | .... | .30 | .41 | 159-176 |

†The load current rating and the overcurrent protection for these conductors shall not exceed 20 amperes for 14 AWG, 25 amperes for 12 AWG, and 40 amperes for 10 AWG copper; or 20 amperes for 12 AWG and 30 amperes for 10 AWG aluminum and copper-clad aluminum.

* For dry locations only. See 75°C column for wet locations.

## Table 310-18. Allowable Ampacities for Insulated Conductors Rated 110 to 250°C

Not More Than Three Conductors in Raceway or Cable Based on Ambient Temperature of 30°C (86°F).

| Size AWG MCM | Temperature Rating of Conductor. See Table 310-13 | | | | | | | | Size AWG MCM |
|---|---|---|---|---|---|---|---|---|---|
| | 110°C (230°F) | 125°C (257°F) | 150°C (302°F) | 200°C (392°F) | 250°C (482°F) | 110°C (230°F) | 125°C (257°F) | 200°C (392°F) | |
| | TYPES AVA, AVL | TYPES AI, AIA | TYPE Z | TYPES A, AA, FEP, FEPB, PFA | TYPES PFAH, TFE | TYPES AVA, AVL | TYPES AI, AIA | TYPES A, AA | |
| | COPPER | | | | NICKEL OR NICKEL-COATED COPPER | ALUMINUM OR COPPER-CLAD ALUMINUM | | | |
| 14 | 30 | 30 | 30 | 30 | 40 | .... | .... | .... | .... |
| 12 | 35 | 40 | 40 | 40 | 55 | 25 | 30 | 30 | 12 |
| 10 | 45 | 50 | 50 | 55 | 75 | 35 | 40 | 45 | 10 |
| 8 | 60 | 65 | 65 | 70 | 95 | 45 | 50 | 55 | 8 |
| 6 | 80 | 85 | 90 | 95 | 120 | 60 | 65 | 75 | 6 |
| 4 | 105 | 115 | 115 | 120 | 145 | 80 | 90 | 95 | 4 |
| 3 | 120 | 130 | 135 | 145 | 170 | 95 | 100 | 115 | 3 |
| 2 | 135 | 145 | 150 | 165 | 195 | 105 | 115 | 130 | 2 |
| 1 | 160 | 170 | 180 | 190 | 220 | 125 | 135 | 150 | 1 |
| 0 | 190 | 200 | 210 | 225 | 250 | 150 | 160 | 180 | 0 |
| 00 | 215 | 230 | 240 | 250 | 280 | 170 | 180 | 200 | 00 |
| 000 | 245 | 265 | 275 | 285 | 315 | 195 | 210 | 225 | 000 |
| 0000 | 275 | 310 | 325 | 340 | 370 | 215 | 245 | 270 | 0000 |
| 250 | 315 | 335 | .... | .... | .... | 250 | 270 | .... | 250 |
| 300 | 345 | 380 | .... | .... | .... | 275 | 305 | .... | 300 |
| 350 | 390 | 420 | .... | .... | .... | 310 | 335 | .... | 350 |
| 400 | 420 | 450 | .... | .... | .... | 335 | 360 | .... | 400 |
| 500 | 470 | 500 | .... | .... | .... | 380 | 405 | .... | 500 |
| 600 | 525 | 545 | .... | .... | .... | 425 | 440 | .... | 600 |
| 700 | 560 | 600 | .... | .... | .... | 455 | 485 | .... | 700 |
| 750 | 580 | 620 | .... | .... | .... | 470 | 500 | .... | 750 |
| 800 | 600 | 640 | .... | .... | .... | 485 | 520 | .... | 800 |
| 1000 | 680 | 730 | .... | .... | .... | 560 | 600 | .... | 1000 |
| 1500 | 785 | .... | .... | .... | .... | 650 | .... | .... | 1500 |
| 2000 | 840 | .... | .... | .... | .... | 705 | .... | .... | 2000 |

CORRECTION FACTORS

| Ambient Temp. °C | For ambient temperatures over 30°C, multiply the ampacities shown above by the appropriate correction factor to determine the maximum allowable load current. | | | | | | | | Ambient Temp. °F |
|---|---|---|---|---|---|---|---|---|---|
| 31-40 | .94 | .95 | .96 | .... | .... | .94 | .95 | .... | 87-104 |
| 41-45 | .90 | .92 | .94 | .... | .... | .90 | .92 | .... | 105-113 |
| 46-50 | .87 | .89 | .91 | .... | .... | .87 | .89 | .... | 114-122 |
| 51-55 | .83 | .86 | .89 | .... | .... | .83 | .86 | .... | 123-131 |
| 56-60 | .79 | .83 | .87 | .91 | .95 | .79 | .83 | .91 | 132-141 |
| 61-70 | .71 | .76 | .82 | .87 | .91 | .71 | .76 | .87 | 142-158 |
| 71-75 | .66 | .72 | .79 | .86 | .89 | .66 | .72 | .86 | 159-167 |
| 76-80 | .61 | .68 | .76 | .84 | .87 | .61 | .69 | .84 | 168-176 |
| 81-90 | .50 | .61 | .71 | .80 | .83 | .50 | .61 | .80 | 177-194 |
| 91-100 | .... | .51 | .65 | .77 | .80 | .... | .51 | .77 | 195-212 |
| 101-120 | .... | .... | .50 | .69 | .72 | .... | .... | .69 | 213-248 |
| 121-140 | .... | .... | .29 | .59 | .59 | .... | .... | .59 | 249-284 |
| 141-160 | .... | .... | .... | .... | .54 | .... | .... | .... | 285-320 |
| 161-180 | .... | .... | .... | .... | .50 | .... | .... | .... | 321-356 |
| 181-200 | .... | .... | .... | .... | .43 | .... | .... | .... | 357-392 |
| 201-225 | .... | .... | .... | .... | .30 | .... | .... | .... | 393-437 |

## Table 310-19. Allowable Ampacities for Insulated Conductors Rated 110 to 250°C, and for Bare and Covered Conductors

Single Conductors in Free Air, Based on Ambient Temperature of 30°C (86°F).

| Size AWG MCM | Temperature Rating of Conductor. See Table 310-13. | | | | | | | | | | Size AWG MCM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 110°C (230°F) | 125°C (257°F) | 150°C (302°F) | 200°C (392°F) | Bare and cov-ered con-duc-tors | 250°C (482°F) | 110°C (230°F) | 125°C (257°F) | 200°C (392°F) | Bare and cov-ered con-duc-tors | |
| | TYPES AVA, AVL | TYPES AI, AIA | TYPE Z | TYPES A, AA, FEP, FEPB, PFA | | TYPES PFAH, TFE | TYPES AVA, AVL | TYPES AI, AIA | TYPES A, AA | | |
| | COPPER | | | | | NICKEL OR NICKEL-COATED COPPER | ALUMINUM OR COPPER-CLAD ALUMINUM | | | | |
| 14 | 40 | 40 | 40 | 45 | 30 | 60 | .... | .... | .... | .... | .... |
| 12 | 50 | 50 | 50 | 55 | 40 | 80 | 40 | 40 | 45 | 30 | 12 |
| 10 | 65 | 70 | 70 | 75 | 55 | 110 | 50 | 55 | 60 | 45 | 10 |
| 8 | 85 | 90 | 95 | 100 | 70 | 145 | 65 | 70 | 80 | 55 | 8 |
| 6 | 120 | 125 | 130 | 135 | 100 | 210 | 95 | 100 | 105 | 80 | 6 |
| 4 | 160 | 170 | 175 | 180 | 130 | 285 | 125 | 135 | 140 | 100 | 4 |
| 3 | 180 | 195 | 200 | 210 | 150 | 335 | 140 | 150 | 165 | 115 | 3 |
| 2 | 210 | 225 | 230 | 240 | 175 | 390 | 165 | 175 | 185 | 135 | 2 |
| 1 | 245 | 265 | 270 | 280 | 205 | 450 | 190 | 205 | 220 | 160 | 1 |
| 0 | 285 | 305 | 310 | 325 | 235 | 545 | 220 | 240 | 255 | 185 | 0 |
| 00 | 330 | 355 | 360 | 370 | 275 | 605 | 255 | 275 | 290 | 215 | 00 |
| 000 | 385 | 410 | 415 | 430 | 320 | 725 | 300 | 320 | 335 | 250 | 000 |
| 0000 | 445 | 475 | 490 | 510 | 370 | 850 | 345 | 370 | 400 | 290 | 0000 |
| 250 | 495 | 530 | .... | .... | 410 | .... | 385 | 415 | .... | 320 | 250 |
| 300 | 555 | 590 | .... | .... | 460 | .... | 435 | 460 | .... | 360 | 300 |
| 350 | 610 | 655 | .... | .... | 510 | .... | 475 | 510 | .... | 400 | 350 |
| 400 | 665 | 710 | .... | .... | 555 | .... | 520 | 555 | .... | 435 | 400 |
| 500 | 765 | 815 | .... | .... | 630 | .... | 595 | 635 | .... | 490 | 500 |
| 600 | 855 | 910 | .... | .... | 710 | .... | 675 | 720 | .... | 560 | 600 |
| 700 | 940 | 1005 | .... | .... | 780 | .... | 745 | 795 | .... | 615 | 700 |
| 750 | 980 | 1045 | .... | .... | 810 | .... | 775 | 825 | .... | 640 | 750 |
| 800 | 1020 | 1085 | .... | .... | 845 | .... | 805 | 855 | .... | 670 | 800 |
| 900 | .... | .... | .... | .... | 905 | .... | .... | .... | .... | 725 | 900 |
| 1000 | 1165 | 1240 | .... | .... | 965 | .... | 930 | 990 | .... | 770 | 1000 |
| 1500 | 1450 | .... | .... | .... | 1215 | .... | 1175 | .... | .... | 985 | 1500 |
| 2000 | 1715 | .... | .... | .... | 1405 | .... | 1425 | .... | .... | 1165 | 2000 |

CORRECTION FACTORS

| Ambient Temp. °C | For ambient temperatures over 30°C, multiply the ampacities shown above by the appropriate correction factor to determine the maximum allowable load current. | | | | | | | | | Ambient Temp. °F |
|---|---|---|---|---|---|---|---|---|---|---|
| 31-40 | .94 | .95 | .96 | .... | | .... | .94 | .95 | .... | 87-104 |
| 41-45 | .90 | .92 | .94 | .... | | .... | .90 | .92 | .... | 105-113 |
| 46-50 | .87 | .89 | .91 | .... | | .... | .87 | .89 | .... | 114-122 |
| 51-55 | .83 | .86 | .89 | .... | | .... | .83 | .86 | .... | 123-131 |
| 56-60 | .79 | .83 | .87 | .91 | | .95 | .79 | .83 | .91 | 132-141 |
| 61-70 | .71 | .76 | .82 | .87 | | .91 | .71 | .76 | .87 | 142-158 |
| 71-75 | .66 | .72 | .79 | .86 | | .89 | .66 | .72 | .86 | 159-167 |
| 76-80 | .61 | .68 | .76 | .84 | | .87 | .61 | .69 | .84 | 168-176 |
| 81-90 | .50 | .61 | .71 | .80 | | .83 | .50 | .61 | .80 | 177-194 |
| 91-100 | .... | .51 | .65 | .77 | | .80 | .... | .51 | .77 | 195-212 |
| 101-120 | .... | .... | .50 | .69 | | .72 | .... | .... | .69 | 213-248 |
| 121-140 | .... | .... | .25 | .59 | | .59 | .... | .... | .59 | 249-284 |
| 141-160 | .... | .... | .... | .... | | .54 | .... | .... | .... | 285-320 |
| 161-180 | .... | .... | .... | .... | | .50 | .... | .... | .... | 321-356 |
| 181-200 | .... | .... | .... | .... | | .43 | .... | .... | .... | 357-392 |
| 201-225 | .... | .... | .... | .... | | .30 | .... | .... | .... | 393-437 |

[6450-01-M]

NOTES TO TABLES 310-16 THROUGH 310-19

1. *Explanation of Tables.* For explanation of Type Letters, and for recognized size of conductors for the various conductor insulations, see Sections 310-12 and 310-13. For insulation requirements, see Sections 310-1 through 310-9, and the various articles of this Code. For flexible cords see Table 400-4 and 400-5.

2. *Application of Tables.* For open wiring on insulators and for concealed knob-and-tube wiring, the allowable ampacities of Tables 310-17 and 310-18 shall be used, unless otherwise provided in this Code.

3. *Three-Wire, Single-Phase Residential Service.* In a residential occupancy conductors, as listed below, shall be permitted to utilize as three-wire, single-phase, service-entrance conductors and the three-wire, single-phase feeder that carries the total current supplied by that service.

CONDUCTOR TYPES AND SIZES RH-RHH-RHW-THW-THWN-THHN-XHHW

| Copper | Aluminum and Copper-clad AL | Service rating amps |
|---|---|---|
| AWG | AWG | |
| 4 | 2 | 100 |
| 3 | 1 | 110 |
| 2 | 1/0 | 125 |
| 1 | 2/0 | 150 |
| 1/0 | 3/0 | 175 |
| 2/0 | 4/0 | 200 |

4. *Type MC Cable.* The ampacities of Type MC cables are determined by the temperature limitation of the insulated conductors incorporated within the cable. Hence the ampacities of Type MC cable may be determined from the columns in Tables 310-16 and 310-18 applicable to the type of insulated conductors employed within the cable.

5. *Bare Conductors.* Where bare conductors are used with insulated conductors, their allowable ampacities shall be limited to that permitted for the insulated conductors of the same size.

6. *Mineral-Insulated, Metal-Sheathed Cable.* The temperature limitation on which the ampacities of mineral-insulated, metal-sheathed cable are based is determined by the insulating materials used in the end seal. Termination fittings incorporating unimpregnated, organic, insulating materials are limited to 85° C operation.

7. *Type MTW Machine Tool Wire.* The ampacities of Type MTW wire are specified in Table 200-B of the Electrical Standard for Metalworking Machine Tools 1977 (NFPA Publication No. 79).

8. *More Than 3 Conductors in a Raceway or Cable.* Where the number of conductors in a raceway or cable exceed 3, the maximum allowable load current of each conductor shall be reduced as shown in the following table:

| Number of conductors | Percent[1] |
|---|---|
| 4 thru 6 | 80 |
| 7 thru 24 | 70 |
| 25 thru 42 | 60 |
| 43 and above | 50 |

[1] Values in table 310-16 and 310-18.

Where single conductors or multiconductor cables are stacked or bundled without maintaining spacing are not installed in raceways, the maximum allowable load current of each conductor shall be reduced as shown in the above table.

Exception No. 1: When conducts of different systems, as provided in Section 300-3, are installed in a common raceway the derating factors shown above shall apply to the number of power and lighting (Articles 210, 215, 220, and 230) conductors only.

Exception No. 2: The derating factors of Sections 210-22(c), 220-2(a) and 220-10(b) shall not apply when the above derating factors are also required.

Exception No. 3: For conducts installed in cable trays, the provisions of Sections 318-10 shall apply.

9. *Overcurrent Protection.* Where the standard ratings and settings of overcurrent devices do not correspond with the ratings and settings allowed for conductors, the next higher standard rating and setting shall be permitted.

Exception: As limited in Section 240-3.

10. *Neutral Conductor.* (a) A neutral conductor which carries only the unbalanced current from other conductors, as in the case of normally balanced circuits of 3 or more conductors, shall not be counted in determining ampacities as provided for in Note 8.

(b) In a 3-wire circuit consisting of 2-phase wires and the neutral of a 4-wire, 3-phase wye-connected system, a common conductor carries approximately the same current as the other conductors and shall be counted in determining ampacities as provided in Note 8.

(c) On a 4-wire, 3-phase wye circuit where the major portion of the load consists of electric-discharge lighting there are harmoic currents present in the neutral conductor and the neutral shall be considered to be a current-carrying conductor.

11. *Grounding Conductor.* A grounding conductor shall not be counted in determining ampacities as provided for in Note 8.

12. *Voltage Drop.* The allowable ampacities in Tables 310-16 through 310-19 are based on temperature alone and do not take voltage drop into consideration.

[6450-01-C]

## APPENDIX C TO SUBPART I, PART 456

### STEADY STATE EFFICIENCY

The steady state efficiency of the furnace may be determined directly from Table 1 for furnaces using No.1 fuel oil or from Table 2 for furnaces using No. 2 fuel oil.

Alternatively the following equations may be used to calculate the furnace efficiency:

$$N_{ss} = 100 - L_{L,A} - L_{S,SS,A}$$

$$R_{T,F} = A + \frac{B}{X_{CO_2,S}}$$

$$L_{S,SS,A} = \frac{100}{HHV_A} \sum_{i=1} [(1 + A/F)(CF(i) + (A/F)(R_{T,F} - 1)(CA(i))] \times [(T_{F,SS} + 460)^i - (T_{RA} + 460)^i]$$

Where:

$N_{SS}$ = Steady state, full load efficiency %

$L_{L,A}$ = Average latent loss, % = 6.55 for No. 1 oil; 6.50 for No. 2 oil

$L_{S,SS,A}$ = Average sensible heat loss, %

$R_{T,F}$ = Ratio of combustion air to stoichiometric air

$X_{CO2,F}$ = Concentration by volume of $CO_2$ present in dry flue gas, %

$T_{F,SS}$ = Flue gas temperature at steady-state, °F

$T_{RA}$ = Ambient temperature in furnace room, °F

Additional required constants are as follows:

| | For No. 1 - Oil | For No. 2 - Oil |
|---|---|---|
| $HHV_A$ | 19,800 | 19,500 |
| A/F | 14.56 | 14.49 |
| A | 0.0679 | 0.06668 |

| | For No. 1 - Oil | For No. 2 - Oil |
|---|---|---|
| B | 14.22 | 14.22 |
| CF (1) | $2.4416834 \times 10^{-1}$ | $2.4361163 \times 10^{-1}$ |
| CF (2) | $3.3711449 \times 10^{-6}$ | $3.6702686 \times 10^{-6}$ |
| CF (3) | $8.8906305 \times 10^{-9}$ | $8.7098897 \times 10^{-9}$ |
| CF (4) | $-1.3619019 \times 10^{-12}$ | $-1.3094378 \times 10^{-12}$ |
| CF (5) | $-1.4367410 \times 10^{-16}$ | $-1.5029209 \times 10^{-16}$ |

| | For Air (continued) |
|---|---|
| CA (1) | $2.5462121 \times 10^{-1}$ |
| CA (2) | $-3.0260126 \times 10^{-5}$ |
| CA (3) | $2.7608571 \times 10^{-8}$ |
| CA (4) | $-7.4253321 \times 10^{-12}$ |
| CA (5) | $6.4307377 \times 10^{-16}$ |

This calculation procedure is explained more fully in:

NBSIR 78-1543, "Recommended Testing and Calculation Procedures for Determining the Seasonal Performance of Residential Control Furnaces and Boilers."

Department of Energy Final Energy Conservation Test Procedures as printed in the Federal Register, Part II, for Wednesday, May 10, 1978.

APPENDIX D TO SUBPART I, PART 456

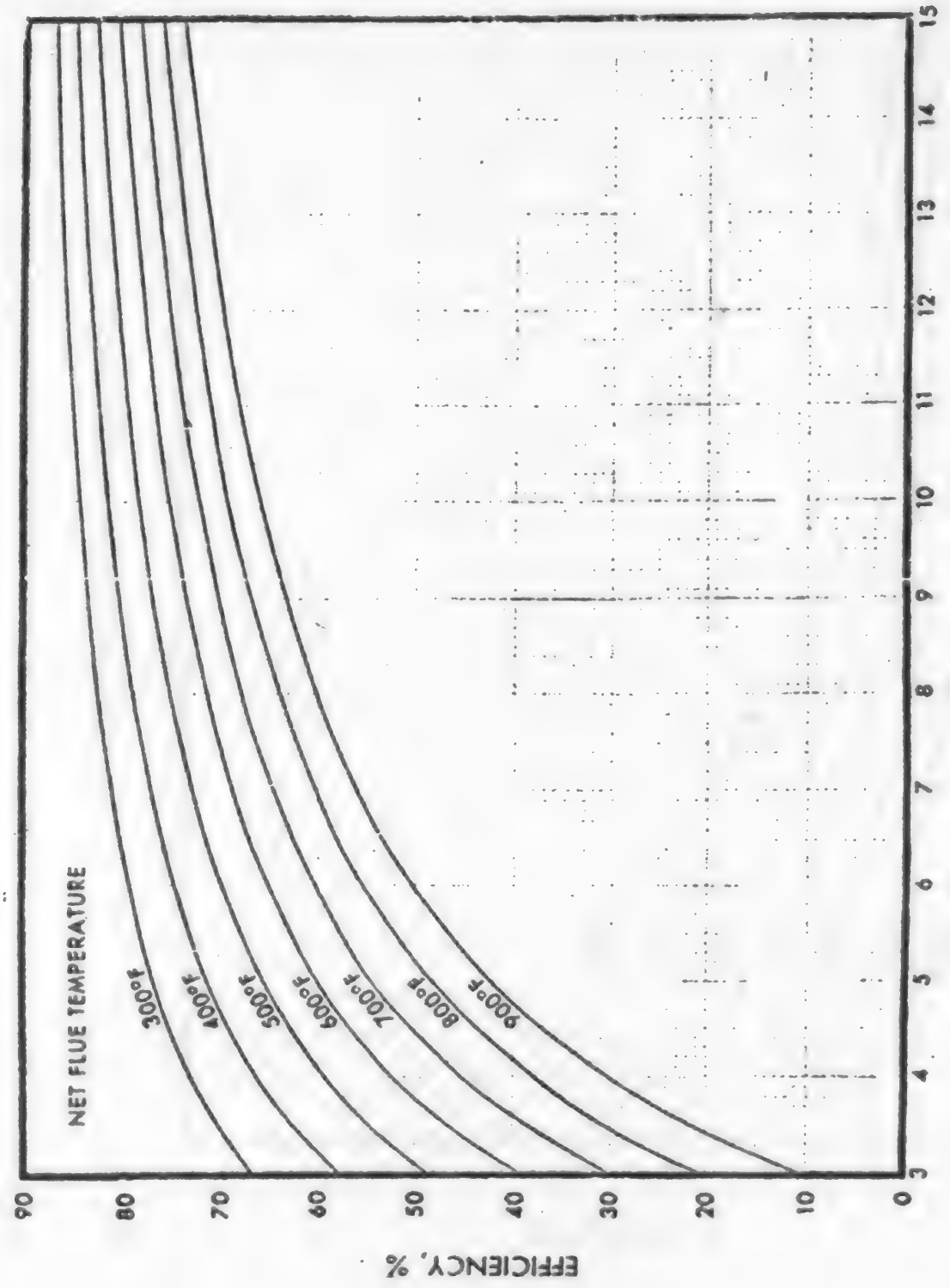



Figure 1. Effect of net flue temperature and percent $CO_2$ on efficiency for furnaces operating on No. 1 heating oil.

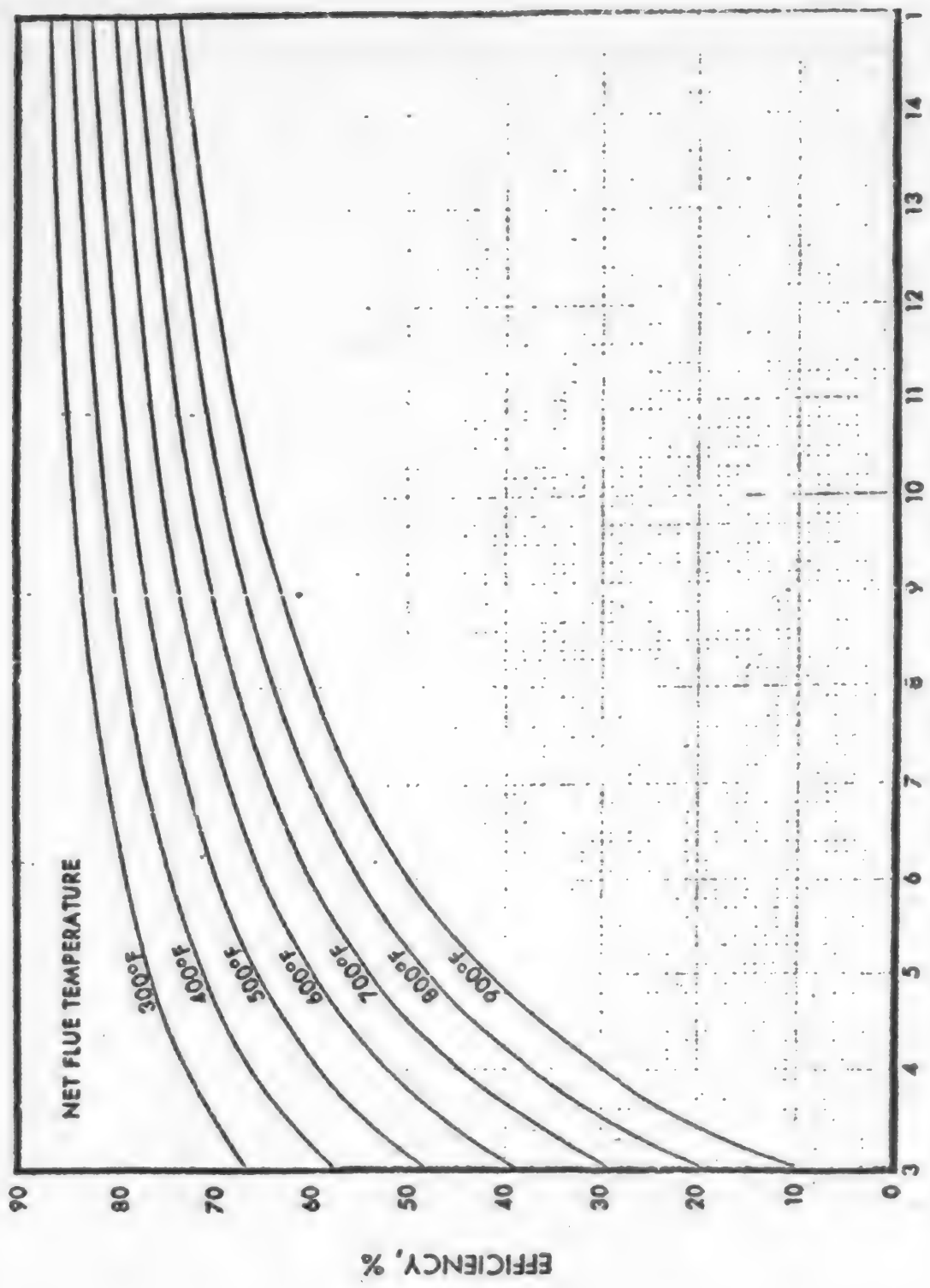



Figure 2. Effect of net flue temperature and percent $CO_2$ on efficiency for furnaces operating on No. 2 heating oil.

SUGGESTED MEASURES (CONSERVATION) APPENDIX I(A) TO PART 456

(a) Climate Zones for Suggested Energy Conservation Measures. In the tables of suggested energy conservation measures shown in "(c)" below, the climate zones are as follows:

| | Heating Degree Days | Cooling Degree Days |
|---|---|---|
| Climate Zone 1 | 0-2000 | Less Than 750 |
| 2 | 2000-4000 | Less Than 750 |
| 3 | 4000-5500 | Less Than 750 |
| 4 | 5500-7000 | Less Than 750 |
| 5 | More than 7000 | Less Than 750 |
| 6 | 0-2000 | More Than 2000 |
| 7 | 2000-4000 | More Than 2000 |
| 8 | 2000-4000 | 750-2000 |
| 9 | 4000-5500 | 750-2000 |
| 10 | 5500-7000 | 750-2000 |

Figures (1) and (2) are respectively maps of heating degree days and cooling degree days.

(b) (1) Load Management Devices. Load Management devices are suggested measures for all categories of buildings if, and only if, the electric utility serving such building offers a load management rate for residential customers. "Load management rate" means a rate charged to eligible customers which reflects the cost savings to the utility from the installation of Devices associated with Electric Load Management Techniques.

(2) Energy Usage Display Meters. Energy Usage Display Meters are suggested measures for all categories of buildings in all State and climate zones.

(3) Replacement Furnaces or Boilers. Repplacement furnaces or boilers are suggested measures for all categories of buildings in all State and climate zones.

(c) Tables of Conservation Measures by State. All other suggested energy conservation measures are displayed in the following tables organized by State.

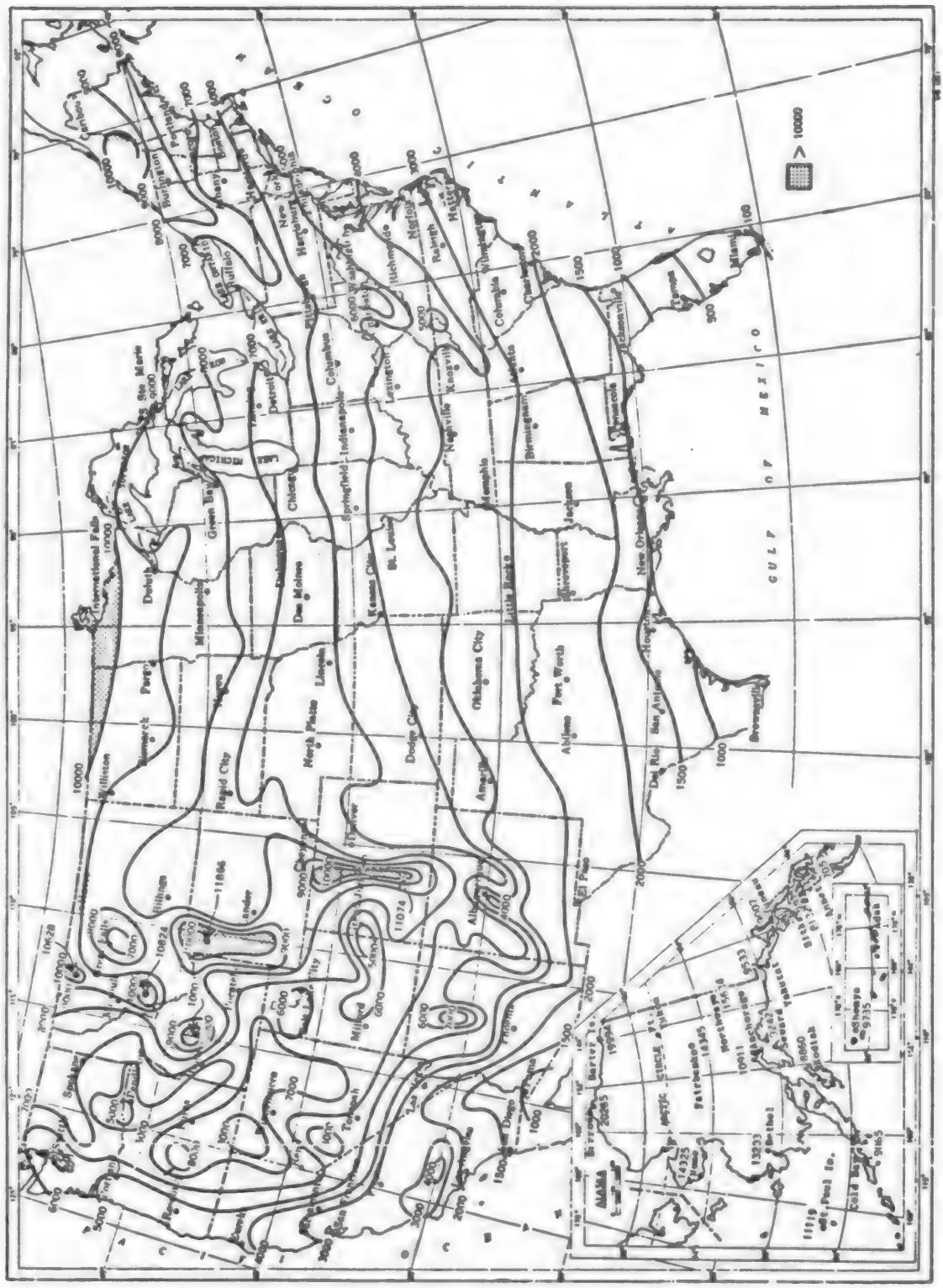
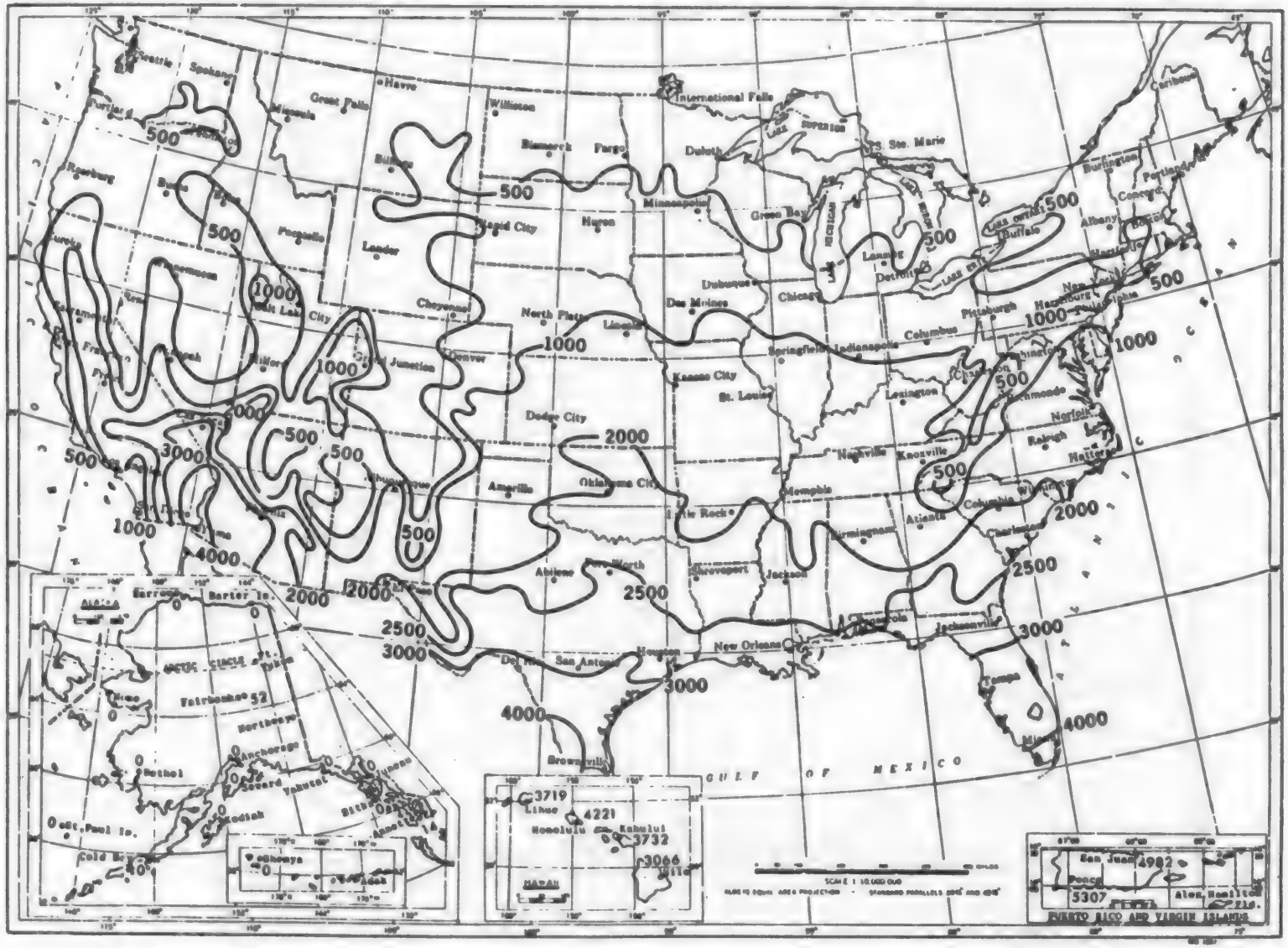



FIGURE 1. NORMAL SEASONAL HEATING DEGREE DAYS ( BASE 65°F ) 1941–1970

NORMAL SEASONAL COOLING DEGREE DAYS ( BASE 65°F ) 1941–1970

FIGURE 2.



STATE: ALABAMA

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | GAS HEAT | | | x | x | R-19 | x | | R-14 | x | x | | | x | x |
| | OIL HEAT | | x | x | | R-19 | x | | R-14 | x | x | | | x | x |
| | ELECTRICAL HEAT | | | | | R-19 | x | | R-14 | x | x | x | | x | x |
| 7 | GAS HEAT | x | | x | x | R-30 | x | | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| 8 | GAS HEAT | x | | x | x | R-30 | x | | R-14 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-14 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: ALASKA

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | GAS HEAT | x | | x | | R-30 | x | R-11 | R-14 | x | X | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: ARIZONA

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| 6 | GAS HEAT | | | x | x | R-19 | x | | R-19 | x | x | x | | x | x |
| | OIL HEAT | | x | x | | R-19 | x | | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | | | | | R-30 | x | | R-19 | x | x | x | | x | x |
| 7 | GAS HEAT | x | | x | x | R-30 | x | | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| 8 | GAS HEAT | x | | x | x | R-30 | x | | R-14 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-14 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-11 | R-19 | x | x | x | | x | x |
| 9 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | | | x |

STATE: ARIZONA (continued)

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: ARKANSAS

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | GAS HEAT | | | x | x | R-19 | x | | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| 8 | GAS HEAT | | | x | x | R-19 | x | | R-14 | x | x | | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-14 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: CALIFORNIA

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | GAS HEAT | | | x | x | R-11 | | | R-5 | x | x | | | | x |
| | OIL HEAT | | x | x | | R-11 | | | R-5 | x | x | | | | x |
| | ELECTRICAL HEAT | | | | | R-19 | | | R-5 | x | x | | | | x |
| 2 | GAS HEAT | | | x | x | R-19 | x | | R-10 | x | x | | | | x |
| | OIL HEAT | x | x | x | | R-19 | x | R-11 | R-10 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| 3 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| 4 | GAS HEAT | x | | x | x | R-30 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| 5 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |

STATE: CALIFORNIA (continued)

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | GAS HEAT | | | x | x | R-19 | x | | R-19 | x | x | x | | x | x |
| | OIL HEAT | | x | x | | R-19 | x | | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | | | | | R-30 | x | | R-19 | x | x | x | | x | x |
| 8 | GAS HEAT | | | x | x | R-19 | x | | R-14 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-14 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| 9 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: COLORADO

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-14 | x | X | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| 5 | GAS HEAT | x | | x | x | R-30 | x | R-19 | R-19 | x | X | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| 9 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-19 | R-19 | x | x | x | | | x |
| 10 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: CONNECTICUT

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | GAS HEAT | x | | x | x | R-30 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| 4 | GAS HEAT | x | | x | x | R-49 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: DELAWARE

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-19 | x | R-19 | R-19 | x | x | x | x | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: DISTRICT OF COLUMBIA

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: FLORIDA

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | GAS HEAT | | | x | x | R-19 | x | | R-19 | x | x | x | | x | x |
| | OIL HEAT | | x | x | | R-19 | x | | R-14 | x | x | x | | x | x |
| | ELECTRICAL HEAT | | | | | R-30 | x | | R-19 | x | x | x | | x | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: GEORGIA

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | GAS HEAT | | | x | x | R-19 | x | | R-14 | x | x | x | | x | x |
| | OIL HEAT | | x | x | | R-19 | x | | R-14 | x | x | | | x | x |
| | ELECTRICAL HEAT | | | | | R-19 | x | | R-14 | x | x | x | | x | x |
| 7 | GAS HEAT | x | | x | x | R-30 | x | | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| 8 | GAS HEAT | x | | x | x | R-30 | x | | R-14 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-14 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: HAWAII

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | GAS HEAT | | | x | x | R-19 | x | | R-19 | x | x | | | x | |
| | OIL HEAT | | x | x | | R-19 | x | | R-19 | x | x | | | x | |
| | ELECTRICAL HEAT | | | | | R-19 | x | | R-19 | x | x | | | x | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: IDAHO

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | GAS HEAT | x | | x | x | R-30 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-19 | R-19 | x | x | x | | | x |
| 5 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: ILLINOIS

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| 8 | GAS HEAT | x | | x | x | R-30 | x | | R-14 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-14 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| 9 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| 10 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: INDIANA

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | | | x |
| 9 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| 10 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: IOWA

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | GAS HEAT | x | | x | x | R-30 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| 5 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| 10 | GAS HEAT | x | | x | x | R-38 | x | R-11 | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: KANSAS

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-14 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| 10 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: KENTUCKY

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | GAS HEAT | | | x | x | R-19 | x | | R-14 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-14 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| 9 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: LOUISIANA

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | GAS HEAT | | | x | x | R-19 | | | R-14 | x | x | | | x | x |
| | OIL HEAT | | x | x | | R-19 | x | | R-14 | x | x | | | x | x |
| | ELECTRICAL HEAT | | | | | R-19 | x | | R-14 | x | x | | | x | x |
| 7 | GAS HEAT | | | x | x | R-19 | x | | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: MAINE

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | GAS HEAT | x | | x | x | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: MARYLAND

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | GAS HEAT | x | | x | x | R-30 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| 8 | GAS HEAT | x | | x | x | R-30 | x | | R-14 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-14 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| 9 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: MASSACHUSETTS

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | GAS HEAT | x | | x | x | R-49 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| 5 | GAS HEAT | x | | x | x | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: MICHIGAN

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| 5 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: MINNESOTA

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: MISSISSIPPI

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | GAS HEAT | | | x | x | R-19 | x | | R-14 | x | x | | | x | x |
| | OIL HEAT | | x | x | | R-19 | x | | R-14 | x | x | | | x | x |
| | ELECTRICAL HEAT | | | | | R-19 | x | | R-14 | x | x | | | x | x |
| 7 | GAS HEAT | x | | x | x | R-30 | x | | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| 8 | GAS HEAT | x | | x | x | R-30 | x | | R-14 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-14 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-14 | x | x | x | | x | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: MISSOURI

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | GAS HEAT | | | x | x | R-30 | x | | R-14 | x | x | x | | x | x |
| | OIL HEAT | | x | x | | R-30 | x | | R-14 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| 9 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| 10 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: MONTANA

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | GAS HEAT | x | | x | x | R-30 | x | R-19 | R-19 | x | X | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | X | x | | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: NEBRASKA

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | GAS HEAT | x | | x | x | R-30 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| 5 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| 10 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: NEVADA

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | GAS HEAT | x | | x | x | R-30 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | | | x |
| 5 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| 7 | GAS HEAT | | | x | x | R-30 | x | | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| 8 | GAS HEAT | | | x | x | R-30 | x | | R-14 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-14 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| 9 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | x | x | | | x |

STATE: NEW HAMPSHIRE

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| 5 | GAS HEAT | x | | x | x | R-49 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: NEW JERSEY

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: NEW MEXICO

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| 7 | GAS HEAT | | | x | x | R-3[illegible] | x | | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-3[illegible] | x | | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| 8 | GAS HEAT | | | x | x | R-19 | x | | R-14 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-14 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| 9 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-14 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | | | x |
| 10 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |

STATE: NEW YORK

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| 5 | GAS HEAT | x | | x | x | R-49 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| 9 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: NORTH CAROLINA

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | GAS HEAT | x | | x | x | R-30 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| 7 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| 8 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-14 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-14 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-19 | x | x | x | | | x |
| 9 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: NORTH DAKOTA

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | GAS HEAT | x | | x | x | R-30 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: OHIO

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| 9 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | x | x | x | | x |
| 10 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: OKLAHOMA

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | GAS HEAT | | | x | x | R-19 | x | | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| 8 | GAS HEAT | | | x | x | R-19 | x | | R-14 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-14 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| 9 | GAS HEAT | | | x | x | R-30 | x | | R-14 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: OREGON

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| 4 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| 5 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: PENNSYLVANIA

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | | | x |
| 4 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| 5 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| 9 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | | | x |
| 10 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |

STATE: RHODE ISLAND

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | GAS HEAT | x | | x | x | R-30 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | | | x |
| 4 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: SOUTH CAROLINA

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | GAS HEAT | | | x | x | R-19 | x | | R-14 | x | x | x | | x | x |
| | OIL HEAT | | x | x | | R-19 | x | | R-14 | x | x | x | | x | x |
| | ELECTRICAL HEAT | | | | | R-19 | x | | R-14 | x | x | x | | x | x |
| 7 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| 8 | GAS HEAT | x | | x | x | R-30 | x | | R-14 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-14 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-19 | x | x | x | | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: SOUTH DAKOTA

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | GAS HEAT | x | | x | x | R-30 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: TENNESSEE

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | GAS HEAT | | | x | x | R-19 | x | | R-14 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-14 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | | R-14 | x | x | x | | | x |
| 9 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-19 | x | x | x | | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: TEXAS

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | GAS HEAT | | | x | x | R-19 | x | | R-14 | x | x | | | x | x |
| | OIL HEAT | | x | x | | R-19 | x | | R-14 | x | x | | | x | x |
| | ELECTRICAL HEAT | | | | | R-19 | x | | R-14 | x | x | x | | x | x |
| 7 | GAS HEAT | | | x | x | R-30 | x | | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| 8 | GAS HEAT | | | x | x | R-19 | x | | R-14 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-14 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| 9 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-14 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: UTAH

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| 5 | GAS HEAT | x | | x | | R-30 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| 10 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: VERMONT

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| 5 | GAS HEAT | x | | x | x | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: VIRGINIA

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | GAS HEAT | x | | x | x | R-30 | x | R-19 | R-14 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| 8 | GAS HEAT | x | | x | x | R-30 | x | | R-14 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | | R-14 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| 9 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-19 | x | x | x | | x | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: WASHINGTON

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-19 | x | R-11 | R-14 | x | x | x | | | x |
| 4 | GAS HEAT | x | | x | x | R-30 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| 5 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-30 | x | R-19 | R-19 | x | x | x | | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: WEST VIRGINIA

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-14 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| 9 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-14 | x | x | x | | x | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-11 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| 10 | GAS HEAT | x | | x | x | R-30 | x | R-11 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: WISCONSIN

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | GAS HEAT | x | | x | x | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-30 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | | | x |
| 5 | GAS HEAT | x | | x | x | R-49 | x | R-19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R-19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-49 | x | R-19 | R-19 | x | x | x | x | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

STATE: WYOMING

| CLIMATE ZONE | BUILDING CATEGORY | CAULKING AND WEATHERSTRIPPING | REPLACEMENT OIL BURNER | VENT DAMPER | ELEC. OR MECH. IGNITION | CEILING INSULATION | WALL INSULATION | FLOOR INSULATION | DUCT INSULATION | PIPE INSULATION | WATER HEATER INSULATION | STORM OR THERMAL WINDOWS | STORM OR THERMAL DOORS | REFL. OR ABS. WINDOW MATERIAL | CLOCK THERMOSTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | GAS HEAT | x | | x | x | R-30 | x | R19 | R-19 | x | x | x | | | x |
| | OIL HEAT | x | x | x | | R-38 | x | R19 | R-19 | x | x | x | | | x |
| | ELECTRICAL HEAT | x | | | | R-38 | x | R19 | R-19 | x | x | x | | | x |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |
| | GAS HEAT | | | | | | | | | | | | | | |
| | OIL HEAT | | | | | | | | | | | | | | |
| | ELECTRICAL HEAT | | | | | | | | | | | | | | |

SUGGESTED MEASURES (RENEWABLE RESOURCES) APPENDIX I(B) PART 456

The following tables show the renewable resource measures which are suggested measures.

(a) The symbols for each measure are:

D: Solar Domestic Hot Water Systems

D: Active Solar Space Heating Systems

D/S: Combined Active Solar Space Heating and Solar Domestic Hot Water Systems

P: Passive Solar Space Heating and Cooling Systems

W: Wind Energy Systems

H: Replacement Solar Swimming Pool Heaters.

(b) (1) There are three buildings types which apply to Active Solar Space Heating Systems (S) and Combined Systems (D/S) (See § 456.306(b)):

Type 1 includes all detached single family residential buildings, except mobile homes.

Type 2 includes all attached single family residential buildings and all multiple dwelling residential buildings.

Type 3 includes mobile homes.

(2) The tables indicate the number of the building types for which these two measures are suggested.

(c) The suggested renewable resources measures are displayed by numerically designated regions within each State. These numerical designations by State and County are:

ALABAMA

1 Colbert
Franklin
Lauderdale
Lawrence

2 Blout
Calhoun
Cleburne
Cherokee
Cullman
Dekalb
Etowah
Jackson
Limestone
Madison
Marshall
St. Clair

3 Autauga
Barbour
Bibb
Bulloch
Butler
Chambers
Chilton
Choctaw
Clay
Coosa
Crenshaw
Dale
Dallas
Elmore
Fayette
Greene
Hale
Henry
Jefferson
Lamar
Lee
Lowndes
Macon
Marengo
Marion
Montgomery
Perry
Pickens
Pike
Randolph
Russell
Shelby
Sumter
Talapoosa
Talladega
Tuscaloosa
Walker
Wilcox
Winston

4 Baldwin
Clarke
Coffee
Conecuh
Covington
Escambia
Geneva
Houston
Mobile
Monroe
Washington

ALASKA

1 Bettles

2 Bethel

3 Nome

4 Barrow

5 Fairbanks

6 Adak

7 Annette Island

8 Gulkana

9 Yakutat

10 Naknek

11 Homer

ARIZONA

1 Apache
Navajo

2 Cochise
Graham
Greenlee

3 Gila
Maricopa
Mohave
Pima
Pinal
Santa Cruz
Yuma

4 Coconino

5 Yavapai

ARKANSAS

1 Baxter
Benton
Boone
Carroll
Cleburne
Conway
Crawford
Franklin
Garland
Johnson
Logan
Madison
Marion
Montgomery
Newton
Perry
Polk
Pope
Saline
Scott
Searcy
Sebastian
Stone
Van Buren
Washington
Yell

2 Clay
Craighead
Crittenden
Cross
Faulkner
Fulton
Greene
Independence
Izard
Jackson
Lawrence
Lee
Lonoke
Mississippi
Monroe
Phillips
Poinsett
Prairie
Pulaski
Randolph
St. Francis
Sharp
White
Woodruff

3 Ashley
Bradley
Calhoun
Clark
Columbia
Dallas
Hempstead
Hot Spring
Howard

La Fayette
Little River
Miller
Nevada
Ouachita
Pike
Sevier
Union

4 Arkansas
Chicot
Cleveland
Desha
Drew
Grant
Jefferson
Lincoln

CALIFORNIA

1 Del Norte
Humboldt
Mendocino

2 Amador
Butte
Calaveras
Colusa
Eldorado
Glenn
Lake
Napa
Nevada
Placer
Plumas
Sacramento
San Joaquin
Shasta
Sierra
Siskiyou
Sutter
Tehama
Trinity
Yol
Yuba

3 Modoc

4 Lassen

5 Alameda
Contra Cost
Marin
Mateo
Monterey
San Benito
San Luis Obispo
Santa Clara
Santa Cruz
Sonoma

6 Fresno
Kern
Kings
Madera
Mariposa
Merced
Stanislaus
Tulare
Tuolumne

7 Alpine
Inyo
Mono

8 Los Angeles
Orange
San Diego
Santa Barbara
Ventura

9 Imperial
Riverside
San Bernardino

COLORADO

1 Moffat

2 Delta
Dolores
Garfield
LaPlata
Mesa
Miguel
Montezuma
Montrose
Rio Blanco
San Juan
San Miguel

3 Alamosa
Archuleta
Chaffe
Clear Creek
Conejos
Costilla
Custer
Douglas
Eagle
El Paso
Fremont
Grand
Gunnison
Hinsdale
Huerfano
Jackson
Jefferson
Lake
Mineral
Park
Pitkin
Rio Grande
Routt
Saguache
Summitt
Teller

4 Adams
Arapahoe
Boulder
Elbert
Larimer
Logan
Morgan
Phillips
Sedgwick
Washington
Weld
Yuma

5 Cheyenne
Kiowa
Kit Carson
Lincoln
Prowers

6 Baca
Bent
Crowley
Lasanimas
Otero
Pueblo

CONNECTICUT

1 Fairfield
Hartford
Litchfield
Middlesex
New Haven
New London
Tolland
Windham

DELAWARE

1 Kent
Newcastle
Sussex

FLORIDA

1 Bay
Calhoun
Escambia
Franklin
Gadsden
Gulf
Hamilton

Holmes
Jefferson
Leon
Liberty
Madison
Okaloosa
Santa Rosa
Taylor
Wakulla
Walton
Washington

2 Alachua
Baker
Bradford
Columbia
Glades
Highlands
Lake
Marion
Okeechobee
Orange
Osceola
Polk
Sanford
Sumter
Union

3 Brevard
Broward
Charlotte
Citrus
Clay
Dade
DeSoto
Dixie
Duval
Flagler
Gilchrist
Gollier
Hardee
Hendry
Hernando
Hillsborough
Indian River
Lafayette
Lee
Levy
Manatee
Martine
Monroe
Nassan
Palm Beach
Pasco
Pinellas
Putnam
St. John
St. Lucie
St. Petersburg
Sarasota
Suwanee
Volusia

GEORGIA

1 Bartow
Chattooga
Cherokee
Cobb
Dawson
Douglas
Fannia
Floyd
Forsyth
Gilmer
Gordon
Haralson
Lumpkin
Murray
Paulding
Pickens
Polk
Rabun
Union
Walker
Whitfield

2 Baldwin
Banks
Barrow
Ben Hill
Bibb
Bleckley
Burke
Butts
Calhoun
Carroll
Chatta-Hoochee
Clarke
Clay
Clayton
Columbia
Columbus
Corvetta
Crawford
Crisp
Decatur
Dodge
Dooly
Dougherty
Elber
Elbert
Fayette
Franklin
Fulton
Glascock
Greene
Gwinnett
Habersham
Hall
Hancock
Harris
Hart
Heard
Henry
Houston
Jackson
Jasper
Jefferson
Johnson
Jones
Lamar
Laurens
Lee
Lincoln
Macon
Madison
Marion
McDuffie
Meriweather
Monroe
Morgan
Newton
Oconee
Oglethorpe
Peach
Pike
Pulaski
Putnam
Quitman
Randolph
Richmond
Rockdale
Schley
Spalding
Stephens
Stewart
Sumter
Talbot
Taliaterro
Taylor
Terrell
Troup
Turner
Twiggs
Upson
Walton
Warren
Washington
Webster
White
Wilcox
Wilkes
Wilkinson
Worth

3 Appling
Atkinson
Bacon
Baker
Berrien
Brantley
Brooks

Bryan
Bulloch
Camden
Candler
Chatham
Charlton
Clinch
Coffee
Colquitt
Cook
Decatur
Early
Echols
Effingham
Emanuel
Evans
Glynn
Grady
Irwin
Jeff Davis
Jenkins
Lanier
Liberty
Long
Lowndes
McIntosh
Miller
Mitchell
Montgomery
Pierce
Seminole
Screven
Tattnall
Telfair
Thomas
Tift
Toombs
Treulten
Ware
Wayne
Wheeler

HAWAII

1 Hawaii

2 Honolulu
Maui

3 Kauai

IDAHO

1 Benewah
Bonner
Boundary
Clearwater
Kootenai
Latah
Lewis
Nez Perce
Shoshone

2 Ada
Adams
Boise
Canyon
Clark
Custer
Elmore
Gem
Idaho
Lemhi
Payette
Valley
Washington

3 Bannock
Bingham
Blaine
Bonneville
Butte
Camas
Cassia
Fort Hall
Fremont
Gooding
Jefferson
Jerome
Lincoln
Madison
Minidoka
Owyhee
Power
Teton
Twin Falls

4 Bear Lake
Caribou
Franklin
Oneida

ILLINOIS

1 Boone
Bureau
Carroll
Cook
Dekalb
Dupage
Henry
Jo Daviess
Kane
Kendall
Lake
Lee
McHenry
Mercer
Ogle
Rock Island
Stephensen
Whiteside
Will
Winnebago

2 Champaign
Clark
Coles
Crawford
Cumberland
DeWitt
Douglas
Edgar
Ford
Grundy
Henderson
Iroquois
Kankakee
Knox
LaSalle
Livingston
Logan
Marcon
Marshall
McLean
Moultrie
Peoria
Piatti
Putnam
Shelby
Stark
Tazewell
Vermillon
Warren
Woodford

3 Adams
Bond
Brown
Calhoun
Cass
Christian
Clinton
Fulton
Greene
Hancock
Jersey
Macoupin
Madison
Mason
McDonough
Menard
Monroe
Montgomery
Morgan
Pike
Randolph
Sangamon
Schuyler
Scott
St. Clair

| | |
|---|---|
| 4 | Alexander |
| | Clay |
| | Edwards |
| | Effingham |
| | Fayette |
| | Franklin |
| | Gallatin |
| | Hamilton |
| | Hardin |
| | Jackson |
| | Jasper |
| | Jefferson |
| | Johnson |
| | Lawrence |
| | Marion |
| | Perry |
| | Pope |
| | Richland |
| | Saline |
| | Union |
| | Wabash |
| | Washington |
| | Wayne |
| | White |
| | Williamson |
| 5 | Massac |
| | Pulaski |

INDIANA

| | |
|---|---|
| 1 | DeKalb |
| | Elkhart |
| | LaGrange |
| | Lake |
| | Laporte |
| | Marshall |
| | Noble |
| | Porter |
| | St.Joseph |
| | Starke |
| | Steuben |
| 2 | Adams |
| | Allen |
| | Bartholomew |
| | Benton |
| | Blackford |
| | Boone |
| | Brown |
| | Carroll |
| | Cass |
| | Clark |
| | Clay |
| | Clinton |
| | Daviess |
| | Dearborn |
| | Decatur |
| | Delaware |
| | Fayette |
| | Floyd |
| | Fountain |
| | Franklin |
| | Fulton |
| | Grant |
| | Greene |
| | Hamilton |
| | Hancock |
| | Harrison |
| | Hendricks |
| | Henry |
| | Howard |
| | Huntington |
| | Jackson |
| | Jasper |
| | Jay |
| | Jefferson |
| | Jennings |
| | Johnson |
| | Knox |
| | Kosciusko |
| | Lawrence |
| | Madison |
| | Marion |
| | Martin |
| | Miami |
| | Monroe |
| | Montgomery |
| | Morgan |
| | Newton |
| | Ohio |
| | Orange |
| | Owen |
| | Parke |
| | Pulaski |
| | Putnam |
| | Randolph |
| | Ripley |
| | Rush |
| | Scott |
| | Shelby |
| | Sullivan |
| | Switzerland |
| | Tippecanoe |
| | Tipton |
| | Union |
| | Vermillion |
| | Vigo |
| | Wabash |
| | Warren |
| | Washington |
| | Wayne |
| | Wells |
| | White |
| | Whiteley |
| 3 | Crawford |
| | Dubois |
| | Gibson |
| | Perry |
| | Pike |
| | Posey |
| | Spencer |
| | Vanderburgh |
| | Warrick |

IOWA

| | |
|---|---|
| 1 | Adair |
| | Adams |
| | Appanoose |
| | Audubon |
| | Benton |
| | Black |
| | Boone |
| | Bremer |
| | Buena Vista |
| | Butler |
| | Calhoun |
| | Cass |
| | Carroll |
| | Cerro |
| | Cherokee |
| | Clarke |
| | Clay |
| | Crawford |
| | Dallas |
| | Davis |
| | Decatur |
| | Dickinson |
| | Emmett |
| | Floyd |
| | Franklin |
| | Fremont |
| | Gordo |
| | Greene |
| | Grundy |
| | Guthrie |
| | Hamilton |
| | Hancock |
| | Hardin |
| | Harrison |
| | Hawk |
| | Henry |
| | Humboldt |
| | Ida |
| | Iowa |
| | Jasper |
| | Jefferson |
| | Johnson |
| | Keokuk |
| | Kosuth |
| | Louisa |
| | Lucas |
| | Madison |
| | Mahaska |
| | Marion |
| | Marshal |
| | Mills |
| | Monona |
| | Monroe |
| | Obrien |
| | Osceola |
| | Page |
| | Palo Alto |
| | Polk |
| | Plymouth |
| | Pocahontas |
| | Potowattamie |
| | Poweshiek |
| | Ringgold |
| | Sac |
| | Shelby |
| | Sioux |
| | Story |
| | Tama |
| | Taylor |

Union
Wapello
Warren
Washington
Wayne
Webster
Winnebago
Woodbury
Worth
Wright

2 Allamakee
Buchannon
Cedar
Chickasaw
Clayton
Clinton
Delaware
Dubuque
Fayette
Howard
Jackson
Jones
Linn
Mitchell
Muscatine
Scott
Winneshiek

KANSAS

1 Cheyenne
Clark
Comanche
Decatur
Edwards
Finney
Ford
Gove
Graham
Grant
Gray
Greeley
Hamilton
Haskell
Hodgeman
Kearney
Krowa
Lane
Logan
Meade
Ness
Pawnee
Rawling
Rush
Scott
Seward
Sheridan
Sherman
Stanton
Stevens
Thomas
Trego
Wallace
Wichita

2 Barber
Barton
Butler
Cloud
Cowley
Dickinson
Ellis
Ellsworth
Harper
Harvey
Jewell
Kingman
Lincoln
Marion
McPherson
Mitchell
Norton
Osborne
Ottawa
Phillips
Pratt
Reno
Republic
Rice
Rooks
Russell
Saline
Sedgwick
Smith
Stafford
Sumner

3 Allen
Anderson
Atchison
Bourbon
Brown
Chase
Cherokee
Clay
Coffey
Crawford
Doniphan
Douglas
Elk
Franklin
Geary
Greenwood
Jackson
Jefferson
Johnson
Labette
Leavenworth
Linn
Lyon
Marshall
Miami
Montgomery
Morris
Nemaha
Neosho
Osage
Pottawatomie
Riley
Shawnee
Waubaunsee
Washington
Wilson
Woodson
Wyandotte

4 Morton

5 Chautauqua

KENTUCKY

1 Anderson
Boone
Bourbon
Boyle
Bracken
Bullitt
Campbell
Carroll
Casey
Fayette
Franklin
Gallatin
Garrard
Grant
Harrison
Henry
Jefferson
Jessamine
Kenton
Lincoln
Marion
Nicholas
Oldham
Owen
Pendleton
Robertson
Scott
Shelby
Spencer
Taylor
Trimble
Woodford

2 Adair
Allen
Barren
Breckinridge
Butler
Cuttenden
Cumberland
Daviess
Edmonson
Grayson
Green
Hancock
Hardin
Hart
Henderson
Hopkins
Larue
Livingston
McLean

Mead
Metcalfe
Monroe
Muhlenberg
Ohio
Russell
Union
Warren
Webster

3 Bath
Boyd
Breathitt
Carle
Carter
Clay
Clinton
Elliott
Estill
Fleming
Greenup
Jackson
Johnson
Laurel
Lawrence
Lee
Lewis
Madison
Magoffin
McCreary
Menifee
Morgan
Owsley
Pulaski
Rockcastle
Rowan
Wayne
Wolfe

4 Ballard
Caldwell
Calloway
Carlisle
Christian
Fulton
Graves
Hickman
Logan
Lyon
Marshall
McCracken
Simpson
Todd
Trigg

5 Bell
Floyd
Harlan
Knott
Knox
Leslie
Letcher
Martin
Perry
Pike
Whiteley

LOUISIANA

1 Avoyelles
Bien Ville
Bossier
Caddo
Caldwell
Catahoula
Claiborne
Concordia
DeSoto
East Carroll
Franklin
Grant
Jackson
LaSalle
Lincoln
Madison
Morehouse
Natchitoches
Quachita
Rapides
Red River
Richland
Sabine
Tensos
Union
Vernon
Webster
West Carroll
Winn

2 Acadia
Allen
Ascension
Assumption
Beauregard
Calcasiu
Cameron
Davis
East Baton Rouge
East Feliciana
Evangeline
Iberia
Iberville
Jefferson
Lafayette
LaFourche
Livingston
Orleans
Plaquemines
Point Coupee
St. Bernard
St. Charles
St. Helena
St. James
St. John the Baptist
St. Landry
St. Martin
St. Mary
St. Tammony
Tangipatioa
Terrebonne
Vermilion
Washington
West Baton Rouge
West Feliciana

MAINE

1 Aroostook
Franklin
Oxford
Penobscot
Piscataquis
Somerset

2 Androscoggin
Cumberland
Hancock
Kennebec
Knox
Lincoln
Sagadahoc
Waldo
Washington
York

MARYLAND

1 Allegany
Garret

2 Washington

3 Anne Arundel
Baltimore
Calvert
Caroline
Carroll
Cecil
Charles
Dorchester
Frederick
Hartford
Howard
Kent
Montgomery
Prince Georges
Queen Annes
Talbot

4 St. Marys
Somerset
Wicomico
Worcester

MASSACHUSETTS

1 Berkshire
Franklin
Hampolen
Hampshire

2 Barnstable
Bristol

Duke
Essex
Middlesex
Nantucket
Norfolk
Plymouth
Suffolk
Worcester

MICHIGAN

1 Alger
Baraga
Chippewa
Delta
Dickison
Gogebic
Houghton
Iron
Newaygo
Luce
Mackinac
Marquette
Menominee
Ontonagon
Schoolcraft

2 Alcona
Allegan
Alpena
Antrim
Arenac
Barry
Bay
Benzie
Berrien
Branch
Calhoun
Cass
Charlesvoix
Cheboygin
Clare
Clinton
Crawford
Eaton
Emmet
Genessee
Gladwin
Grand Traverse
Gratio
Hillsdale
Huron
Ingham
Ionia
Iosco
Isabella
Jackson
Kalamazoo
Kalkaska
Kent
Lake
Lapeer
Leelanau
Lenawee
Livingston
Macomb
Manistee
Mason
Mecosta
Midland
Missaukee
Monroe
Montcalm
Montmorency
Muskegon
Newayco
Oakland
Oceana
Ogemaw
Osceola
Oscoda
Otsego
Ottawa
Presque Isle
Roscommon
Saginaw
St. Clair
St. Joseph
Samilac
Shiawassee
Tuscola
Van Buren
Washtenaw
Wayne
Wexford

MINNESOTA

1 Becker
Beltrami
Big Stone
Cass
Chippewa
Clay
Clearwater
Crow
Douglas
Grant
Hubbard
Itasca
Kittson
Koochicking
Lac Qui Parle
Lake of the Woods
Manhomen
Marshall
Norman
Otter
Pennington
Polk
Pope
Red Lake
Roseau
Stevens
Swift
Todd
Traverse
Wadena
Wilkin

2 Aitkin
Anoka
Benton
Carlton
Chisago
Cook
Hennepin
Isanti
Lake
Kanabec
Kandiyohi
Meeker
Mille Lacs
Morrison
Pine
St. Louis
St. Paul
Sherburne
Stearns
Washington
Wright

3 Blue Earth
Brown
Carver
Dakota
Dodge
Faribault
Fillmore
Freeborn
Goodhue
Houston
LeSeur
Lyon
McLeod
Mower
Nicollet
Olmstead
Redwood
Renville
Rice
Scott
Sibley
Steele
Wabasha
Watonwan
Waseca
Winona
Yellow
Medicine

4 Cottonwood
Jackson

Lincoln
Martin
Murray
Nobles
Pipestone
Rock

MISSISSIPPI

1 Alcorn
Benton
DeSoto
Marshall
Prentiss
Tate
Tippah
Tishomingo
Tunica

2 Atlala
Calhoun
Carroll
Chicksaw
Choctaw
Claiborne
Clark
Coahoma
Copiah
Grenada
Hinds
Holmer
Humphreys
Issaquen
Itawamba
Jasper
Kempier
Lafayette
Lauderdale
Leake
Lee
Leftore
Lowndes
Madison
Monroe
Montgomery
Neshoba
Newton
Noxubee
Oktibbeha
Olivar
Panola
Pontotoc
Quitman
Rankin
Scott
Sharkey
Simpson
Smith
Sunflower
Tallahatchie
Union
Warren
Washington
Webster
Winston
Yalobusha
Yazoo

3 Adams
Amite
Davis
Franklin
Jefferson
Lawrence
Lincoln
Marion
Pike
Walthall
Wilkinson

4 Covington
Forrest
George
Greene
Hancock
Harrison
Jackson
Jones
Lamar
Pearl River
Perry
Stone
Wayne

MISSOURI

1 Butler
Carter
Dunklin
Mississippi
New Madrid
Oregon
Pemiscot
Ripley
Scott
Stoddard

2 Barry
Howell
McDonald
Newton
Ozark
Stone
Taney

3 Barton
Camden
Cedar
Christian
Dade
Dallas
Dent
Douglas
Green
Hickory
Iron
Jasper
Laclede
Lawrence
Madison
Miller
Phelps
Polk
Pulaski
Reynolds
Shannon
Texas
Wayne
Webster
Wright

4 Adair
Andrew
Atchison
Audrain
Bates
Benton
Bollinger
Boone
Buchanon
Caldwell
Callaway
Cape Girardeau
Carroll
Cass
Chariton
Clark
Clay
Clinton
Cole
Cooper
Crawford
Daviess
De Kalb
Franklin
Gasconade
Gentry
Grundy
Harrison
Henry
Holt
Howard
Jackson
Jefferson
Johnson
Knox
Lafayette
Lewis
Lincoln
Linn
Livingston
Macon
Maries
Marion
Mercer
Monroe
Montgomery
Morgan
Nodaway
Osage
Perry
Petis
Pike
Platte
Putnam

Ralls
Randolph
Ray
St. Charles
St. Clair
St. Francois
Ste. Genevieve
Schuyler
Scotland
Shelby
Sullivan
Vernon
Warren
Washington
Worth

MONTANA

1 Flathead
Lake
Lincoln
Mineral
Missoula
Powell
Sanders

2 Blaine
Cascade
Chouteau
Daniels
Fergus
Glacier
Hill
Liberty
McCone
Phillips
Pondera
Richland
Roosevelt
Sheridan
Teton
Toole
Valley

3 Basin
Beaverhead
Broadwater
Carbon
Deer Lodge
Gallatin Park
Golden Valley
Granite
Jefferson
Judith
Lewis and Clark
Madison
Meagher
Ravalli
Silver Bow
Stillwater
Sweet Grass
Wheatland
Yellowstone
National Park

4 Big Horn
Yellowstone

5 Carton
Custer
Dawson
Fallon
Garfield
Musselshell
Petroleum
Powder
Prairie
River
Rosebud
Treasure
Wilbaux

NEBRASKA

1 Cherry
Dawes
Sheridan

2 Anteloupe
Blaine
Boone
Boyd
Brown
Buffalo
Burt
Butler
Cass
Cedar
Colfax
Cuming
Custer
Dakota
Dawson
Dixon
Dodge
Douglas
Garfield
Gosper
Greeley
Hall
Hamilton
Holt
Howard
Keya Paha
Knox
Lancaster
Loup
Madison
Merrick
Nance
Otoe
Philips
Pierce
Platte
Polk
Rock
Sarpy
Saunders
Seward
Sherman
Stanton
Thurston
Valley
Washington
Wayne
Wheeler
York

3 Hitchcock
Red Willow

4 Franklin
Furnas
Harlan
Kearney
Nuckolls
Webster

5 Adams
Clay
Gage
Jefferson
Johnson
Nemaha
Pawnee
Phillmore
Richardson
Saline
Thayer

NEVADA

| | |
|---|---|
| 1 | Elko |
| | Humboldt |
| 2 | Eureka |
| | Lander |
| | Pershing |
| | Washoe |
| | White Pine |
| 3 | Carson City |
| | Clarke |
| | Churchill |
| | Douglas |
| | Esmerelda |
| | Lincoln |
| | Lyon |
| | Mineral |
| | Nye |
| | Storey |

NEW HAMPSHIRE

| | |
|---|---|
| 1 | Coos |
| | Grafton |
| 2 | Belknap |
| | Carroll |
| | Cheshire |
| | Hillsboro |
| | Merrimac |
| | Rockingham |
| | Stafford |
| | Sullivan |

NEW JERSEY

| | |
|---|---|
| 1 | Atlantic |
| | Bergen |
| | Burlington |
| | Camden |
| | Cape May |
| | Cumberland |
| | Essex |
| | Gloucester |
| | Hudson |
| | Hunterdon |
| | Mercer |
| | Middlesex |
| | Monmouth |
| | Morris |
| | Ocean |
| | Passaic |
| | Salem |
| | Somerset |
| | Sussex |
| | Union |
| | Warren |

NEW MEXICO

| | |
|---|---|
| 1 | Colfax |
| | Harding |
| | Union |
| 2 | Chaves |
| | Curry |
| | DeBaca |
| | Eddy |
| | Guadalupe |
| | Lea |
| | Lincoln |
| | Quay |
| | Roosevelt |
| | San Miguel |
| | Torrance |
| 3 | Catron |
| | Dona Ana |
| | Grant |
| | Hidalgo |
| | Luna |
| | Otero |
| | Sierra |
| 4 | San Juan |
| 5 | Arriba |
| | Bernalillo |
| | McKinley |
| | Sandoval |
| | Santa Fe |
| | Socorro |
| | Valencia |
| 6 | Mora |
| | Taos |

NEW YORK

| | |
|---|---|
| 1 | Clinton |
| | Erie |
| | Franklin |
| | Genesee |
| | Jefferson |
| | Lewis |
| | Monroe |
| | Niagara |
| | Onondaga |
| | Orleans |
| | Oswego |
| | Saint Lawrence |
| | Wayne |
| 2 | Essex |
| | Saratoga |
| | Warren |
| | Washington |
| 3 | Chautauqua |
| 4 | Allegheny |
| | Broome |
| | Cattaraugus |

| | |
|---|---|
| | Cayuga |
| | Chemung |
| | Chenango |
| | Cortland |
| | Hamilton |
| | Herkimer |
| | Livingston |
| | Madison |
| | Oneida |
| | Ontario |
| | Otsego |
| | Schuler |
| | Seneca |
| | Steuben |
| | Tioga |
| | Tompkins |
| | Wyoming |
| | Yates |
| 5 | Albany |
| | Delaware |
| | Fulton |
| | Greene |
| | Montgomery |
| | Rensselaer |
| | Schenectady |
| | Schoharie |
| | Sullivan |
| | Ulster |
| 6 | Columbia |
| 7 | Bronx |
| | Dutchess |
| | Kings |
| | Manhattan Island |
| | Nassau |
| | Orange |
| | Putnam |
| | Queens |
| | Richmond |
| | Rockland |
| | Suffolk |
| | Westchester |

NORTH CAROLINA

| | |
|---|---|
| 1 | Alamance |
| | Alexander |
| | Alleghany |
| | Ashe |
| | Avery |
| | Burke |
| | Cabarrus |
| | Caldwell |
| | Caswell |
| | Catawba |
| | Chatham |
| | Cleveland |
| | Davidson |
| | Davie |
| | Durham |
| | Edgecombe |
| | Forsyth |
| | Franklin |
| | Gaston |
| | Granville |
| | Guilford |
| | Halifax |
| | Iredell |
| | Johnston |
| | Lee |
| | Lincoln |
| | McDowell |
| | Mecklenburg |
| | Montgomery |
| | Moore |
| | Nash |
| | Northampton |
| | Orange |
| | Person |
| | Polk |
| | Randolph |
| | Rockingham |
| | Rowan |
| | Rutherford |
| | Stanly |
| | Stokes |
| | Surry |
| | Union |
| | Vance |
| | Wake |
| | Warren |
| | Watauga |
| | Wilkes |
| | Wilson |
| | Yadkin |
| 2 | Beaufort |
| | Bertie |
| | Camden |
| | Chowan |
| | Currituck |
| | Dare |
| | Gates |
| | Hertford |
| | Hyde |
| | Martin |
| | Pasquotank |
| | Perquimans |
| | Pitt |
| | Tyrrell |
| | Washington |
| 3 | Buncombe |
| | Cherokee |
| | Clay |
| | Graham |
| | Haywood |
| | Henderson |
| | Jackson |
| | Macon |
| | Madison |
| | Mitchell |
| | Swain |
| | Transylvania |
| | Yancey |
| 4 | Anson |
| | Cumberland |
| | Harnett |
| | Hoke |
| | Richmond |
| | Robeson |
| | Scotland |
| 5 | Bladen |
| | Brunswick |
| | Carter |
| | Columbus |
| | Craven |
| | Duplin |
| | Greene |
| | Jones |
| | Lenoir |
| | New Hanover |
| | Onslow |
| | Pamlico |
| | Pender |
| | Sampson |
| | Wayne |

NORTH DAKOTA

| | |
|---|---|
| 1 | Barnes |
| | Benson |
| | Billings |
| | Botineau |
| | Burke |
| | Burleigh |
| | Cass |
| | Cavalier |
| | Dickey |
| | Divide |
| | Dunn |
| | Eddy |
| | Emmons |
| | Foster |
| | Golden Valley |
| | Grand Forks |
| | Grant |
| | Griggs |
| | Hettinger |
| | Kidder |
| | Lamore |
| | Logan |
| | McHenry |
| | McIntosh |
| | McKen |
| | McLean |

Mercer
Morton
Mountrail
Nelson
Oliver
Pembina
Pierce
Ramsey
Ransom
Renville
Richland
Rolette
Sargent
Sheridan
Stark
Steele
Stutsman
Towner
Trail
Walsh
Ward
Wells
Williams

2 Adams
Bowman
Slope

3 Sioux

OHIO

1 Defiance
Fulton
Henry
Lucas
Williams
Wood

2 Ashtabula
Cuyahoga
Erie
Huron
Lake
Lorain
Ottawa
Sandusky
Seneca

3 Allen
Ashland
Auglaize
Brown
Butler
Champaign
Clark
Clermont
Clinton
Crawford
Darke
Delaware
Fayette
Greene
Hamilton
Hancock
Hardin
Logan
Madison
Marion
Mercer
Miami
Montgomery
Morrow
Paulding
Preble
Putnam
Richland
Shelby
Union
Van Wert
Warren
Wyandot

4 Geauga
Mahoning
Medina
Portage
Summit
Trumbull

5 Adams
Athens
Belmont
Carroll
Columbiana
Coshocton
Fairfield
Franklin
Gallia
Guernsey
Harrison
Hocking
Holmes
Jackson
Jefferson
Knox
Lawrence
Licking
Meigs
Monroe
Morgan
Muskingum
Noble
Perry
Pickaway
Pike
Ross
Scioto
Stark
Tuscarawa
Vinton
Washington
Wayne

OKLAHOMA

1 Cimarron
Texas

2 Beaver
Ellis
Harper
Woods
Woodward

3 Alfalfa
Beckham
Blaine
Caddo
Canadian
Cleveland
Comanche
Cotton
Custer
Dewey
Garfield
Grady
Gran
Greer
Harmon
Jackson
Jefferson
Kay
Kingfisher
Kiowa
Logan
Major
McClain
Noble
Oklahoma
Roger Mills
Stevens
Tillman
Washita

4 Adair
Cherokee
Craig
Creek
Delaware
Lincoln
Mayes
McIntosh
Muskogee
Nowata
Okmulgee
Osage
Ottawa
Pawnee
Payne

Oconee
Orangeburg
Pickens
Richland
Salvda
Spartanburg
Sumter
Union
York

2 Allendale
Beaufort
Berkely
Charleston
Clarendon
Colleton
Dorchester
Florence
Georgetown
Hampton
Harry
Jasper
Marion
Williamsburg

SOUTH DAKOTA

1 Bennett
Butte
Custer
Fall River
Haakon
Harding
Jackson
Lawrence
Mead
Penington
Perkins
Shannon
Washabaugh
Ziebach

2 Aurora
Beadle
Bon Homme
Brookings
Brule
Buffalo
Campbell
Carson
Charles Mix
Clark
Clay
Davison
Dewey
Douglas
Edmunds
Faulk
Gregory
Hamlin
Hand
Hanson
Hughes
Hutchinson
Hyde
Jerauld
Jones
Kingsbury
Lake
Lincoln
Lyman
McCook
Mellette
Miner
Minnehaha
Moody
Potter
Sanborn
Spink
Stanley
Sully
Todd
Tripp
Turner
Union
Walworth
Yankton

3 Brown
Codington
Deul
Day
Grant
Marshall
McPherson
Roberts

TENNESSEE

1 Clay
Macon

2 Benton
Carroll
Cheatham
Chester
Crockett
Davidson
Decatur
Dickson
Dyer
Fayette
Gibson
Giles
Hardeman
Hardin
Haywood
Henderson
Henry
Hickman
Houston
Humphreys
Lake
Lauderdale
Lawrence
Lewis
Madison
Maury
McNairy
Montgomery
Ohion
Perry
Robertson
Rutherford
Shelby
Smith
Stewart
Sumner
Tipton
Trousdale
Wayne
Weakley
Williamson
Wilson

3 Cumberland
Fentress
Jackson
Overton
Picket
Putnam
Scott

4 Anderson
Blount
Campbell
Carter
Claiborne
Cocke
Grainger
Greene
Hamblen
Hancock
Hawkins
Jefferson
Johnson
Knox
Loudon
Morgan
Roane
Sevier
Sullivan
Union
Washington

5 Bedford
Bledsoe
Bradley
Cannon
Coffee
Dekalb
Franklin
Grundy
Hamilton

Lincoln
Marion
McMinn
Meigs
Monroe
Moore
Polk
Rhea
Sequatchie
Van Buren
Warren
White

TEXAS

1 Carson
Dallam
Deaf
Hansford
Harley
Hutchinson
Moore
Ochiltree
Oldham
Potter
Randall
Roberts
Sherman
Smith

2 Andrews
Bailey
Cochran
Crane
Dawson
Ector
Gaines
Hockley
Lamb
Loving
Lubbock
Lynn
Martin
Midland
Parmer
Terry
Ward
Winkler
Yoakum

3 Brewster
Culberson
El Paso
Hudspeth
Jeff Davis
Pecos
Presidio
Reeves
Terrell
Val Verde

4 Hemphill
Lipscomb

5 Archer
Armstrong
Baylor
Borden
Briscoe
Castro
Childress
Clay
Collingsworth
Cottle
Crosby
Dickens
Donley
Fisher
Floyd
Foard
Garza
Gray
Hale
Hall
Hardeman
Haskell
Jack
Jones
Kent
King
Knox
Motley
Palo
Pinto
Scurry
Shackelford
Stephens
Stonewall
Swisher
Wheeler
Wilbarger
Wichita
Young

6 Atascosa
Bandera
Bear
Blanco
Brown
Burnet
Callahan
Coleman
Coke
Commanche
Concho
Crockett
Dimmitt
Eastland
Edwards
Erath
Frio
Gillespie
Glassock
Hamilton
Howard
Irion
Karnes
Kendall
Kerr
Kimble
Kinney
Lampasas
LaSalle
Llano
Maverick
Mason
McCulloch
McMullen
Medina
Menard
Mills
Mitchell
Nolan
Reagan
Real
Runnels
San Saba
Schleicher
Sterling
Sutton
Taylor
Tom Green
Upton
Uvalde
Webb
Wilson
Zapato
Zavala

7 Anderson
Angelina
Bastrop
Bell
Bosque
Brazos
Burleson
Caldwell
Cherokee
Collin
Comal
Cook
Coryell
Celta
Denton
Ellis
Falls
Fannin
Franklin
Freestone
Gonzales
Grayson
Gregg
Grimes
Guadaloupe
Hays
Henderson
Hill
Hood

Hopkins
Houston
Hunt
Johnson
Kauffman
Lamar
Lee
Leon
Limestone
Madison
McLennan
Milam
Montague
Nacogdoches
Navarro
Parker
Polk
Rains
Red River
Robertson
Rusk
San Jacinto
Smith
Somervill
Tarrant
Titus
Trinity
Travis
Tyler
Upshur
Van Znadt
Walker
Washington
Williamson
Wise
Wood

8 Bowle
Cass
Harrison
Marion
Panola
Sabine
San Augustine
Shelby

9 Austin
Brazoria
Chambers
Colorado
Dewitt
Fayette
Ft. Bend
Galveston
Hardin
Harris
Jackson
Jasper
Jefferson
Lavaca
Liberty
Matagorda
Montgomery
Newton
Orange
Victoria
Waller
Wharton

10 Alice
Aransas
Bee
Brooks
Calhoun
Cameron
Duval
Goliad
Hidalgo
Jim Hogg
Kennedy
Kleburg
LIve Oak
Nueces
Refugio
San Patricio
Starr
Wallacy

UTAH

1 Box Elder
Cache
Carbon
Dagget
Davis
Duchesne
Juab
Morgan
Rich
Salt Lake
Sanpete
Summit
Tooele
Utah
Vintah
Wasatch
Weber

2 Beaver
Garfield
Iron
Kane
Millard
Piute
Sevier
Washington

3 Emergy
Grand
San Juan
Wayne

VERMONT

1 Addison
Caledonia
Chittenden
Essex
Franklin
Grand Isle
Lamoille
Orange
Orleans
Rutland
Washington
Windsor

2 Bennington
Windham

VIRGINIA

1 Alleghany
Augusta
Bath
Bland
Botetort
Buchanan
Clarke
Craig
Dickinson
Frederick
Giles
Highland
Lee
Montgomery
Page
Pulaski
Roanoke
Rockbridge
Rockingham
Russell
Scott
Shenandoah
Smyth
Tazewell
Warren
Washington
Wise
Wythe

2 Albemarle
Amelia
Amherst
Appomattox
Bedford

Brunswick
Buckingham
Campbell
Caroline
Carroll
Charlotte
Chesterfield
Culpeper
Cumberland
Dinwiddie
Fauquier
Floyd
Fluvanna
Franklin
Grayson
Greensville
Greene
Goochland
Halifax
Hanover
Henrico
Henry
King George
Louisa
Lunenburg
Madison
Mecklenburg
Nelson
Notaway
Orange
Patrick
Pittsylvania
Powhatan
Prince Edward
Rappahanock
Spotsylvania
Stafford

3 Arlington
Fairfax
Loudon
Prince William

4 Charles City
Essex
Gloucester
Isle of Wight
James City
King and Queen
King William
Lancaster
Matthews
Middlesex
New Kent
Newport News
Norfolk
Northumberland
Portsmouth
Prince George
Richmond
Southampton
Suffolk
Surry
Sussex
Westmoreland
Virginia Beach
York

WASHINGTON

1 Clallam
Grays Harbor
Jefferson
Mason
Pacific
Wahkiakum

2 Clark
Cowlitz
Island
Kiry
Kitsap
Lewis
Pierce
Skagit
Snohomish
Whatcom

3 Chelan
Ferry
Kittitas
Okanogan
Perd Oreille
Skamania
Stevens

4 Adams
Asotin
Benton
Columbia
Douglas
Franklin
Garfield
Grant
Lincoln
Spokane
Walla Walla
Whitman

WEST VIRGINIA

1 Brooke
Cabell
Doddridge
Hancock
Jackson
Marshall
Mason
Ohio
Pleasants
Putnam
Ritchie
Roane
Tyler
Wayne
Wetzel
Wirt
Wood

2 Barbour
Berkeley
Boone
Braxton
Calhoun
Clay
Fayette
Gilmer
Grant
Greenbrier
Hampshire
Hardy
Harrison
Jefferson
Kanawha
Lewis
Lincoln
Logan
Marion
McDowell
Mercer
Mineral
Mingo
Monongalia
Monroe
Morgan
Nicholas
Pendleton
Pocahontas
Preston
Raleigh
Randolph
Summer
Taylor
Tucker
Upshur
Webster
Wyoming

WISCONSIN

1 Ashland
Barren
Bayfield
Burnett
Chippewa
Douglas
Dunn
Eau Claire
Florence
Forest
Iron

Langlade
Lincoln
Marinette
Oconto
Oneida
Polk
Price
Rusk
St. Croix
Sawyer
Taylor
Vilas
Washburn

2 Adams
Brown
Buffalo
Calumet
Clark
Columbia
Crawford
Dane
Dodge
Door
Fond du Lac
Grant
Gree Lake
Green
Iowa
Jackson
Jefferson
Juneau
Kenosha
Kewaunee
La Crosse
Lafayette
Mantowoc
Marathon
Marquette
Menomee
Milwaukee
Monroe
Outagamie
Ozaukee
Perin
Pierce
Portage
Racine
Richland
Rock
Sauk
Shawarro
Sheboygan
Trempealean
Vernon
Walworth
Washington
Waukesha
Waupaca
Waushara
Winnebago
Wood

WYOMING

1 Yellowstone
National Park
Park

2 Big Horn
Johnson
Sheridan

3 Campbell
Crook
Niobrava
Weston

4 Carbon
Fremont
Sublette
Sweetwater
Teton

5 Albany
Converse
Hot Springs
Natrona
Washakie

6 Goshen
Laramie
Platte

7 Lincoln
Uinta

STATE: ALABAMA

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | | X | | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 3 | ELECTRICITY | X | | | X | | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 4 | ELECTRICITY | X | | | X | | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE : ALASKA (1)

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | | | | X | X | |
| | OIL | | | | X | | |
| | NATURAL GAS | | | | X | | |
| 2 | ELECTRICITY | | | | X | X | |
| | OIL | | | | X | | |
| | NATURAL GAS | | | | X | | |
| 3 | ELECTRICITY | | | | X | X | |
| | OIL | | | | X | | |
| | NATURAL GAS | | | | X | | |
| 4 | ELECTRICITY | | | | X | X | |
| | OIL | | | | X | | |
| | NATURAL GAS | | | | X | | |
| 5 | ELECTRICITY | | | | X | X | |
| | OIL | | | | X | | |
| | NATURAL GAS | | | | X | | |
| 6 | ELECTRICITY | | | | X | X | |
| | OIL | | | | X | | |
| | NATURAL GAS | | | | X | | |
| 7 | ELECTRICITY | | | | X | X | |
| | OIL | | | | X | | |
| | NATURAL GAS | | | | X | | |
| 8 | ELECTRICITY | | | | X | X | |
| | OIL | | | | X | | |
| | NATURAL GAS | | | | X | | |

STATE : ALASKA (2)

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 9 | ELECTRICITY | | | | x | x | |
| | OIL | | | | x | | |
| | NATURAL GAS | | | | x | | |
| 10 | ELECTRICITY | | | | x | x | |
| | OIL | | | | x | | |
| | NATURAL GAS | | | | x | | |
| 11 | ELECTRICITY | | | | x | x | |
| | OIL | | | | x | | |
| | NATURAL GAS | | | | x | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: ARIZONA

| Region | Fuel Displaced | Solar Measure | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | 1,2 | 1,2 | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | 1,2 | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 3 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 4 | ELECTRICITY | X | 1,2 | 1,2,3 | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 5 | ELECTRICITY | X | 1,2 | 1,2 | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: ARKANSAS

| Region | Fuel Displaced | Solar Measure | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 3 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 4 | ELECTRICITY | X | | | X | | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: CALIFORNIA (1)

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | 1,2 | 1,2 | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 3 | ELECTRICITY | X | 2 | 1,2 | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 4 | ELECTRICITY | X | 1,2 | 1,2 | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 5 | ELECTRICITY | X | 1 | 1 | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 6 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 7 | ELECTRICITY | X | 1,2 | 1,2 | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 8 | ELECTRICITY | X | | | X | | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |

STATE : CALIFORNIA (2)

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 9 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: COLORADO

| Region | Fuel Displaced | Solar Measure | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 3 | ELECTRICITY | X | 1,2 | 1,2 | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 4 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 5 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 6 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: CONNECTICUT

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: DELAWARE

| Region | Fuel Displaced | Solar Measure | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: DISTRICT OF COLUMBIA

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: FLORIDA

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 3 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: GEORGIA

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | | X | | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 3 | ELECTRICITY | X | | | X | | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: HAWAII

| Region | Fuel Displaced | Solar Measure | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 3 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: IDAHO

| Region | Fuel Displaced | Solar Measure | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 2 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 3 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 4 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: ILLINOIS

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 3 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 4 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 5 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: INDIANA

| Region | Fuel Displaced | Solar Measure | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | | | | X | X | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 2 | ELECTRICITY | | | | X | X | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 3 | ELECTRICITY | X | | | X | | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: IOWA

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: KANSAS

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 3 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 4 | ELECTRICITY | X | 1,2 | 1,2 | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 5 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: KENTUCKY

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 2 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 3 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 4 | ELECTRICITY | X | | | X | | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 5 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: LOUISIANA

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | | X | | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE : MAINE

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 2 | ELECTRICITY | | | | X | X | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: MARYLAND

| Region | Fuel Displaced | Solar Measure | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | |
| | NATURAL GAS | X | | | X | | |
| 3 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 4 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: MASSACHUSETTS

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: MICHIGAN

| Region | Fuel Displaced | Solar Measure | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | x | | | x | x | x |
| | OIL | x | | | x | | x |
| | NATURAL GAS | x | | | x | | x |
| 2 | ELECTRICITY | x | | | x | x | x |
| | OIL | x | | | x | | x |
| | NATURAL GAS | x | | | x | | x |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: MINNESOTA

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | | | | X | X | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 3 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 4 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: MISSOURI

| Region | Fuel Displaced | Solar Measure | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 3 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 4 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: MISSISSIPPI

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | | X | | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 3 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 4 | ELECTRICITY | X | | | X | | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: MONTANA

| Region | Fuel Displaced | Solar Measure | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 2 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 3 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 4 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 5 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: NEBRASKA

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 3 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 4 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 5 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: NEVADA

| Region | Fuel Displaced | Solar Measure | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | x | 1,2 | 1,2 | x | | x |
| | OIL | x | | | x | | x |
| | NATURAL GAS | x | | | x | | x |
| 2 | ELECTRICITY | x | 1,2 | 1,2 | x | | x |
| | OIL | x | | | x | | x |
| | NATURAL GAS | x | | | x | | x |
| 3 | ELECTRICITY | x | 1,2 | 1,2 | x | x | x |
| | OIL | x | | | x | | x |
| | NATURAL GAS | x | | | x | | x |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: NEW HAMPSHIRE

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: NEW JERSEY

| Region | Fuel Displaced | Solar Measure | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: NEW MEXICO

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | 1,2 | 1,2 | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | 1,2 | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 3 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 4 | ELECTRICITY | X | 1,2 | 1,2 | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 5 | ELECTRICITY | X | 1,2 | 1,2 | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 6 | ELECTRICITY | X | 1,2 | 1,2 | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: NEW YORK

| Region | Fuel Displaced | Solar Measure | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 3 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 4 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 5 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 6 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 7 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: NORTH CAROLINA

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 3 | ELECTRICITY | X | | | X | | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 4 | ELECTRICITY | X | | | X | | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 5 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: NORTH DAKOTA

| Region | Fuel Displaced | Solar Measure | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | | | | X | X | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 2 | ELECTRICITY | | | | X | X | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 3 | ELECTRICITY | | | | X | X | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: OHIO

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 3 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 4 | ELECTRICITY | | | | X | X | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 5 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: OKLAHOMA

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | 1 | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 3 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 4 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 5 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: OREGON

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 2 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 3 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 4 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 5 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 6 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: PENNSYLVANIA

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 3 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 4 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 5 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 6 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: PUERTO RICO

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: RHODE ISLAND

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: SOUTH CAROLINA

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE : SOUTH DAKOTA

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 2 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 3 | ELECTRICITY | | | | X | X | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: TENNESSEE

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 2 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 3 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 4 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 5 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: TEXAS (1)

| Region | Fuel Displaced | Solar Measure | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | 1 | 1,2 | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 3 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 4 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 5 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 6 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 7 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 8 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |

STATE: TEXAS (2)

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 9 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 10 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE : UTAH

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | 1,2 | 1,2 | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 3 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: VERMONT

| Region | Fuel Displaced | Solar Measure | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | x | | | x | x | x |
| | OIL | x | | | x | | x |
| | NATURAL GAS | x | | | x | | x |
| 2 | ELECTRICITY | x | | | x | x | x |
| | OIL | x | | | x | | x |
| | NATURAL GAS | x | | | x | | x |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: VIRGINIA

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | X | | | X | | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 2 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 3 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| 4 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: WASHINGTON

| Region | Fuel Displaced | Solar Measure | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 2 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 3 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 4 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE : WEST VIRGINIA

| Region | Fuel Displaced | Solar Measure | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | | | | X | X | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 2 | ELECTRICITY | X | | | X | | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
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| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: WISCONSIN

| REGION | FUEL DISPLACED | SOLAR MEASURE | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | | | | X | X | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 2 | ELECTRICITY | X | | | X | X | X |
| | OIL | X | | | X | | X |
| | NATURAL GAS | X | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

STATE: WYOMING

| Region | Fuel Displaced | Solar Measure | | | | | |
|---|---|---|---|---|---|---|---|
| | | D | S | D/S | P | W | H |
| 1 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 2 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 3 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 4 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 5 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| 6 | ELECTRICITY | | | | X | | X |
| | OIL | | | | X | | X |
| | NATURAL GAS | | | | X | | X |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |
| | ELECTRICITY | | | | | | |
| | OIL | | | | | | |
| | NATURAL GAS | | | | | | |

[6450-01-M]

APPENDIX II TO PART 456

BILLING DISPUTES RESOLUTION

(a) The biller must acknowledge receipt of the complaint within 30 days after receipt, unless resolution occurs during such 30-day period, and must resolve the dispute prior to taking any action to collect the disputed portion.

(b) To resolve a billing dispute, the biller shall, within two complete billing cycles (in no event more than 90 days) of receipt of the notification:

(i) Correct the account for any disputed portions (plus related penalties) when the complaint is justified and notify the customer of the correction; or

(ii) Where applicable, notify the customer of disputed amounts when investigation shows the complaint is unjustified (together with documentary evidence requested), including the reasons why such amounts are believed to be correct.

(c) The biller shall permit the customer at least 10 days from receipt of the notification described in (b) to pay any disputed amounts that are properly due. Where the customer pays within this time period, no late charges, acceleration of undisputed portions of the debt, reporting of nonpayment or of the existence of a dispute to any third party, or other penalties shall accrue as a result of withholding of disputed portions.

(i) After receiving notification of a billing error; the biller may not directly or indirectly, threaten to report adversely to any person regarding the customer's credit standing or credit rating because of the customer's failure to pay the amount specified in such notification as being a billing error, or any finance charges, late payment charges, or other charges imposed thereon, nor shall such amount be reported as delinquent or as being in dispute, to any third person unless such amount remains unpaid after the biller has complied with all the requirements or this Paragraph and has allowed that customer the same number of days thereafter to pay as it customarily or by agreement allows, whichever is longer (in no case less than 10 days), for the customer to pay undisputed amounts so as to avoid the imposition of additional finance charges, late payment charges, or other charges.

(ii) If, within the time limit allowed for payment in Subparagraph (i), the biller receives a further written notification from the customer that any portion of a billing error resolved under this paragrpah is still in dispute, the biller may not report to any third party that such disputed amount is delinquent unless the biller also reports that the amount or account is in dispute and, at the same time, notifies the customer in writing of the name and address of each party to whom the biller is reporting information concerning the disputed amount. If, pursuant to this Subparagraph, a biller has reported a disputed amount as being delinquent to any third person, the biller shall report promptly in writing to any such person subsequent resolution of the reported delinquency.

(iii) If a biller has reported an amount as being delinquent to any third person who is in the business of collection and disseminating information relating to the creditworthiness of customers, and such amount is subsequently disputed by the customer, the biller shall, within one billing cycle after receipt of proper written notification of the billing error, mail or deliver a written notice to each such third person to whom the delinquency was reported that the amount is in dispute.

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